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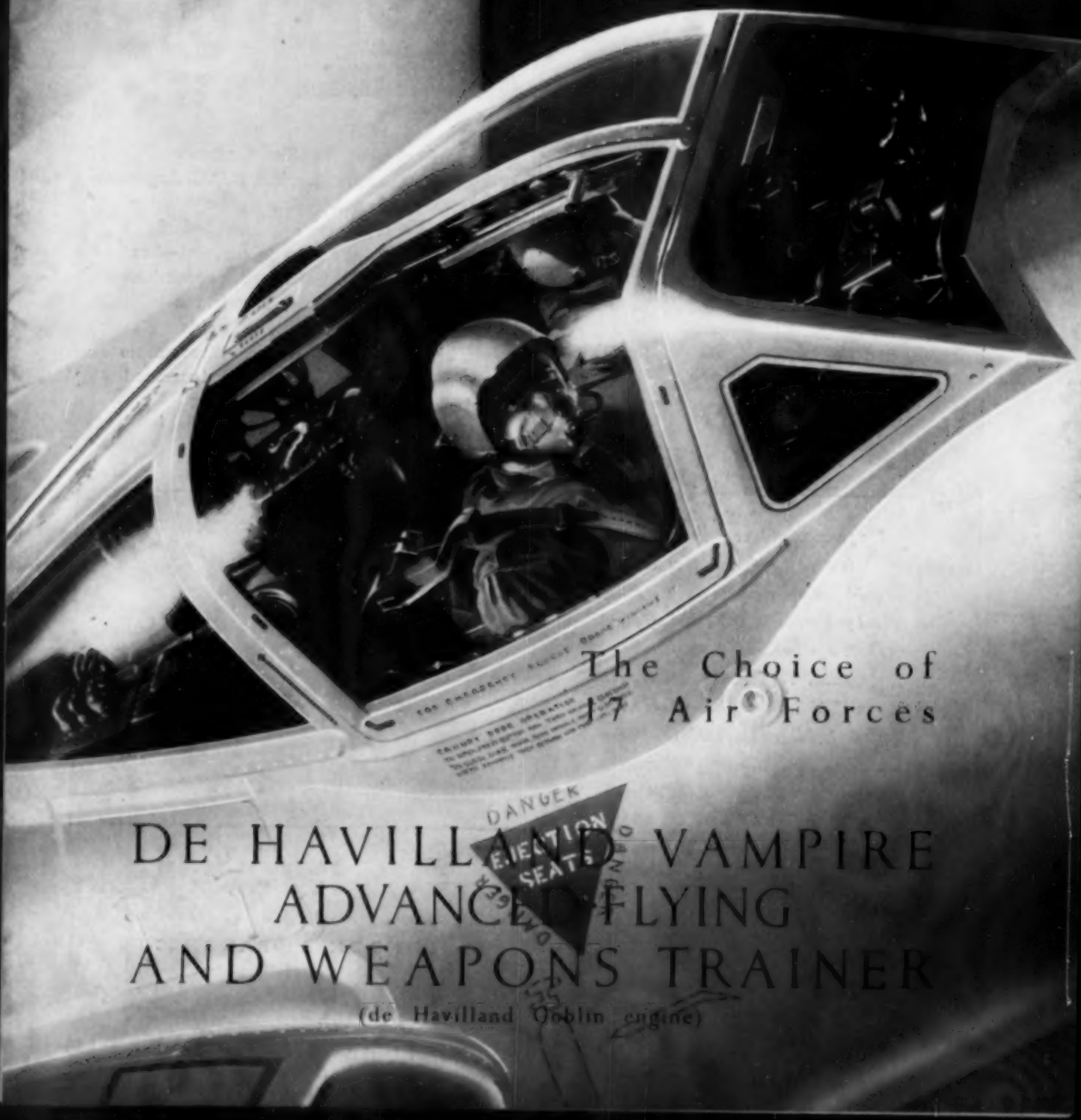

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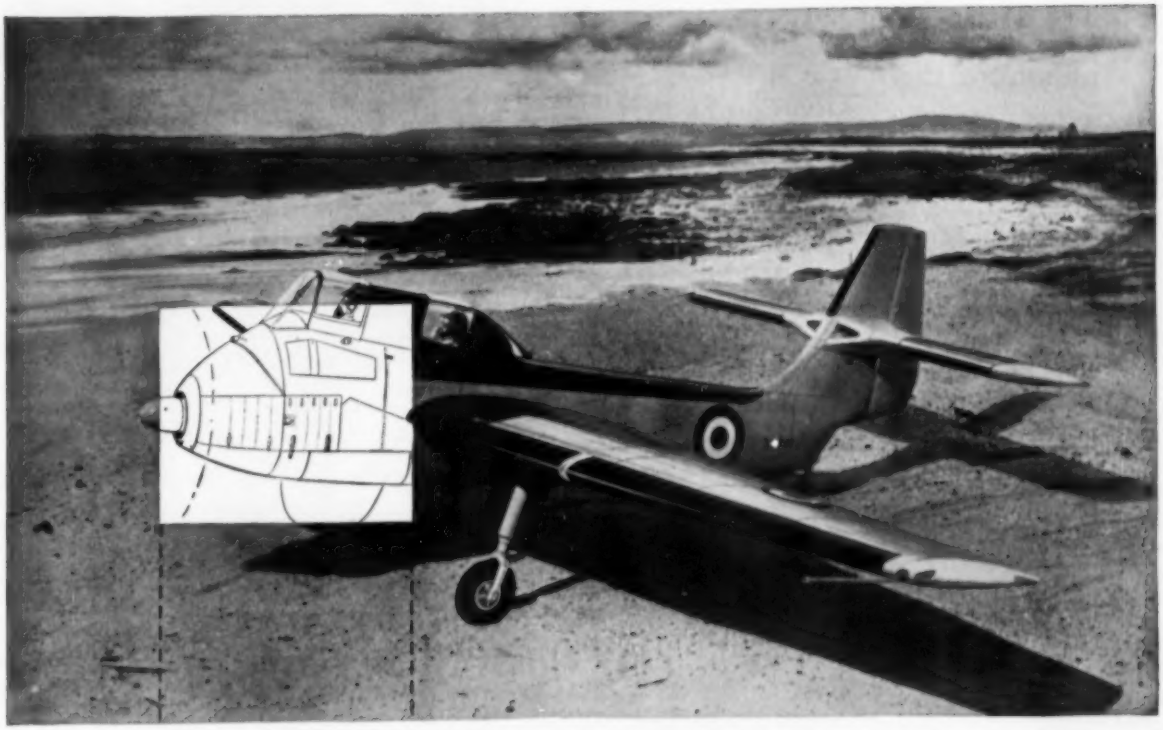

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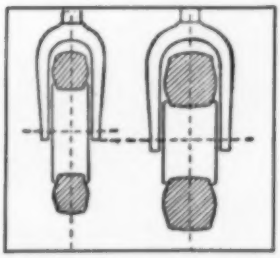
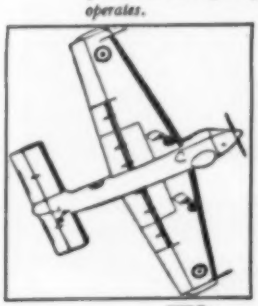


The wheels of the Seamew can be swiftly changed, with differing sizes of tyre to suit the surfaces from which it operates.



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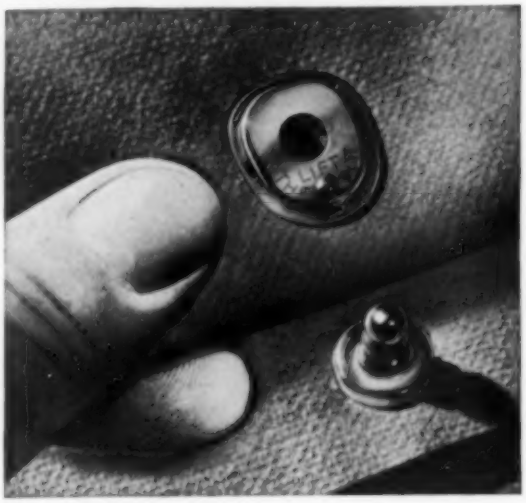

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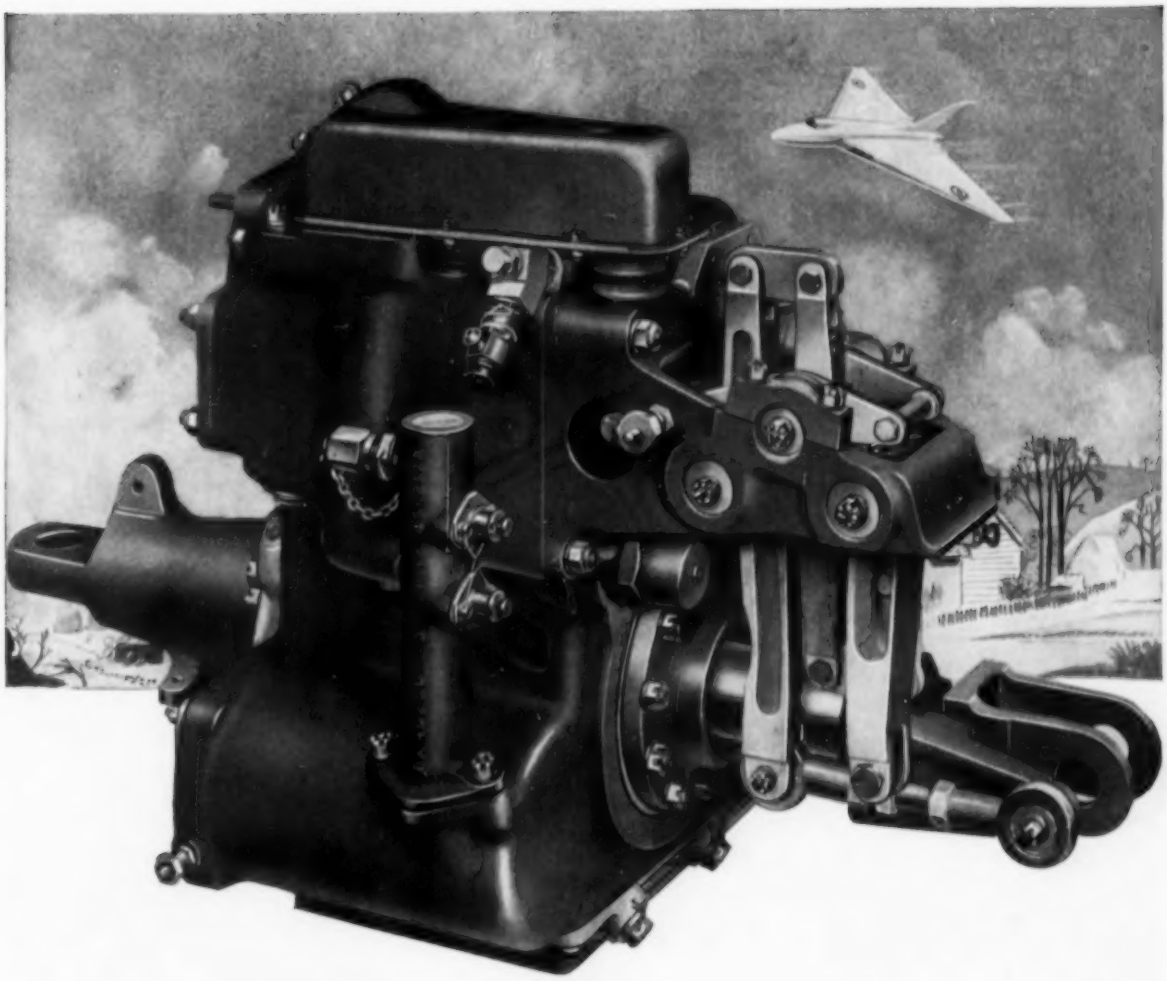

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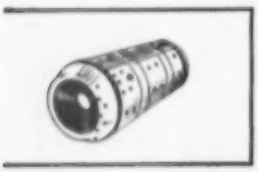

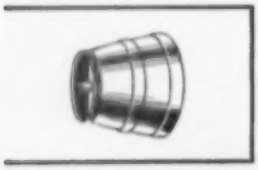

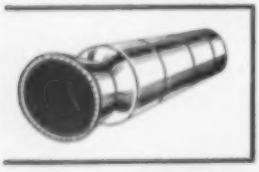

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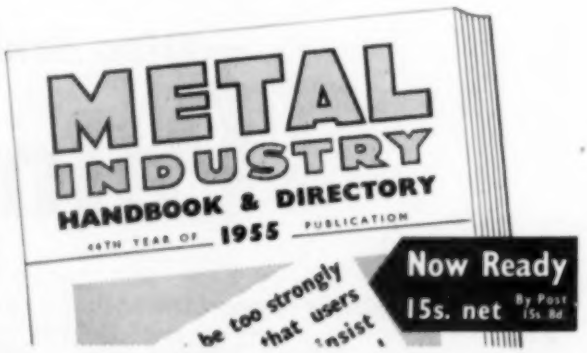

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Revolutionary Aircraft

DURING the past two weeks a pioneer in aviation and the most successful of all designers of helicopters has been a guest on these shores. Mr. Igor Sikorsky, who came here to lecture, and to receive his James Watt Medal, may have had one regret on returning by air to his adopted America: he must have had all too little time to see England at its best in a mild and sunny spring. The aircraft industry, on the other hand, has profited by his devotion to his work and the cause of the helicopter; in rapid visits and at a succession of meetings and public engagements, Mr. Sikorsky has spread charm and infectious enthusiasm for his "whirly birds."

What news has he brought and what novelties revealed? Frankly, few; for helicopter developments are much less obscured by military or commercial security than are those of other types of aircraft, and his company have for a long time past been commendably forthcoming with their announcements and news. What Mr. Sikorsky did do during his visit was to put forward the case for the helicopter more eloquently and convincingly than had previously been done, and to outline more clearly its possibilities and the lines of development for the future.

The prime advantage of these machines is seen in their unique ability to lift and carry from anywhere to anywhere else, albeit relatively slowly and for only short distances. In extreme cases where neither solid nor liquid surface is available for touching down, the helicopter is still able to hover a few feet from the ground for a load to be attached or unhooked, or while a ground crew disembarks and removes obstacles to landing. The extent of the ability to lift weight and bulk is technically almost without limitation and, moreover, the helicopter can itself fly to its load and deliver it at its ultimate destination without depending upon any form of intermediate surface transport, which would of necessity place dimensional limitations, if not those of weight, upon the object to be transported.

Any attempt to stretch the operational domain of the pure helicopter is almost certain, with present knowledge and experience, to result in impaired performance in other respects. In particular, additional lifting surfaces may increase speed and range, but only at the expense of payload and (probably) good hovering characteristics.

For the Near Future

Answers to broad, everyday questions offer great encouragement for the future. Small, economical helicopters of the staff-car-*cum*-taxi kind can and will be a practical proposition. Large helicopters for short-haul passenger and freight services await only time, money and experience for their appearance, and they offer the promise of economical operation and thus convenient and profitable services at low fares.

The helicopter is not a competitor for the fixed-wing aircraft, although it will probably supersede a few specialized designs. Its real work will be accomplished between places and over distances which the fixed-wing transport could not handle at all. It will, in fact, augment the services of today's airlines, and no doubt assist by feeding them new customers who could otherwise have no air connections.

It has been estimated that helicopter evacuation of serious casualties in military operations has already resulted directly in the saving of 11,000 lives. We agree with Mr. Sikorsky that this work alone more than justifies every penny paid out and every moment of effort expended on these aircraft. In recent weeks we have devoted much space to the humanitarian aspects of helicopter operations. This is because we regard them as extremely important, yet find the plans of civil authorities to exploit their value practically non-existent, and at best haphazard. We have no doubt that the pure helicopter is here to stay; it is not just a stepping-stone towards the convertiplane or jet "Vertocraft." It will be developed in many sizes and several configurations; it will find a multitude of worthwhile applications.

With such a potent future in view, we should like to see more done to expand the capacity of British industry to design, build, test and operate helicopters.

FROM ALL QUARTERS

IN TRIPLICATE: Described in detail on pp. 582-587 of this issue, the Hunting Percival Jet Provost T.1 is the first British jet basic trainer. The neat vic illustrated is composed of the second, third and fourth machines of the Service-test batch now being evaluated by the Royal Air Force.

Britain's New Engines—

TWO of the most important aero engines in the world at the present time are Armstrong Siddeley's Screamer and de Havilland's Spectre—both liquid-propellant rocket motors intended for installation in ultra-high-altitude fighters, either as the sole powerplant or in combination with one or more turbojets.

Both the companies concerned have considerable experience in the field of aircraft rocketry, Armstrong Siddeley with the Snarler (a 2,000-lb thrust liquid-oxygen/alcohol motor which was flown in 1950 and 1951), and de Havilland with the Sprite and Super Sprite, the latter a 4,000 lb-thrust hydrogen peroxide/kerosine motor equipped as a jettisonable pack for assisting the take-off of V-bombers. The Super Sprite was the first rocket motor to receive a M.o.S. approved type certificate.

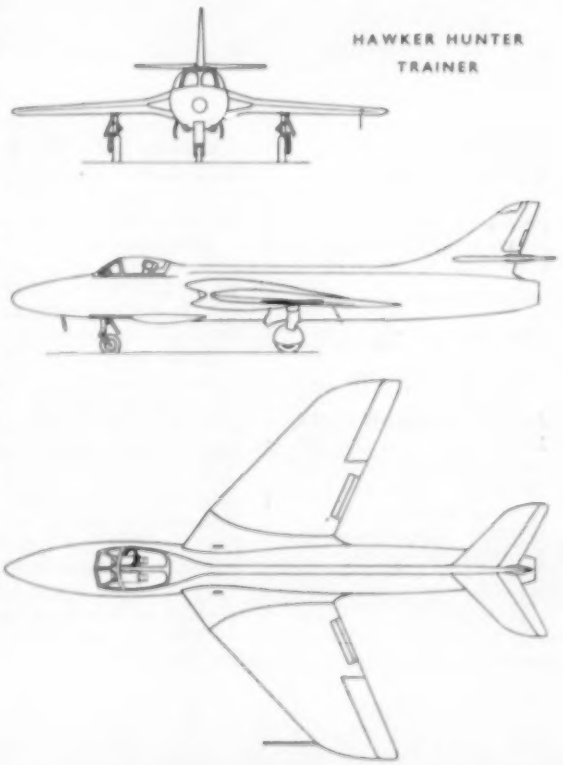
Of the Screamer, it can be said that it uses two propellants. The company have stated that "aviation turbine fuel is an obvious choice for one," but the oxidant has not been revealed; in the Snarler, the company used liquid oxygen, owing to its ease of handling, low cost and high performance. A.S. are, however, now working on other propellants, presumably in addition to "lox." The Screamer has been running at the Bitteswell test-beds for some time, and is now almost ready to fly in a Meteor.

In their announcement of the Spectre (of which no fewer than five types, DSpe. 1 to 5, may be mentioned), the de Havilland Engine Company also refer to their Gyron turbojet, stating that "the combination of the Spectre and the Gyron type of engine will provide a mixed powerplant formula which, in addition to the more obvious advantages of speed, acceleration, and manœuvrability in the stratosphere, makes possible an ability to perform a very rapid take-off and to maintain an outstanding rate of climb to extreme altitudes. Considerable experience has already been gained during extensive test-bed firing. Flight trials with the Spectre are scheduled to take place in the summer of 1955."

Other new engines announced are the Armstrong Siddeley Sapphire ASSa.9 (of which nothing may be said, although it is pertinent to note that the Sapphire has already reached a five-figure type-tested thrust rating); a new Bristol Olympus (BOL 11); the 2,300 lb-thrust A.S. Viper ASV.10; and the Rolls-Royce Nene RN.6. The latter is an up-rated engine for the Sea Hawk naval fighter, and has a type-tested thrust of 5,400 lb at 12,700 r.p.m.—a rather higher speed than that of previous Nenes. Three powerful new turboprops, principally intended for the future civil-transport market, are the Napier Eland NEl.4, the Rolls-Royce R.B. 109 and the Bristol B.E.25. All three employ air-cooled turbine blading; however, no details of this can be given.

—and Aircraft

MENTION is officially authorized for the first time of a new Bristol helicopter, the Type 191, which may be described as a developed version of the 173. Intended for anti-submarine work, it is to be powered with two Alvis Leonides engines. Fairey's ultra-light helicopter is assigned a reconnaissance rôle and is powered by a Turboméca Palouste. The Hawker Hunter F.6 is a fighter with Avon turbojet of unspecified mark, and the trainer version of the Hunter, illustrated for the first time on this page, is also Avon-powered. No mark number is yet allocated to the aircraft itself. The first Fokker-assembled Hunter has flown.



HUNTER TRAINER: A maker's drawing showing the new Avon-powered side-by-side-seater instructional version of the Hawker Hunter. Mention of this development, and of the F.6 Hunter variant, is now officially permitted. Note two guns and absence of external air brakes. Length is 48ft 10½in, over 3ft more than that of the Hunter fighter.

Mutual Defence Contracts

A REPORT on the Mutual Defence Assistance Programme for the fiscal year 1954, issued by the United States Defence Department, shows that the U.S.A.F. in Europe contracted to buy Gloster Javelin all-weather fighters to the value of $64,328,000 (about £23m). Mention is also made of Hunter contracts worth $10,920,000 (nearly £4m), and of orders for Armstrong Siddeley Sapphire turbojets amounting to $8,929,000 (just over £3m). Sea Hawk orders placed by the U.S. Navy amount to $5,421,920 (over £1.9m), and there is an order for Link trainers valued at $252,591 (£90,000).

In the period between 1952 and the end of 1954, the U.S.A.F. ordered aircraft and equipment to the value of $443,600,000 (£155m), while orders placed by the U.S. Navy amounted to $19,800,000 (over £7m). Of U.S.A.F. orders, $442,500,000 (£154½m) went to European countries, including $221,100,000 (£76m) to Britain, $20 million (£7m) to Germany, $91,200,000 (£32½m) to France, $39,900,000 (over £14m) to Switzerland, $39 million (£14m) to Italy, $30,300,000 (£11m) to Holland, and $20,900,000 (7½m) to Belgium and Luxembourg. All the U.S. Navy orders were placed in Great Britain.

Jet Pioneers

IT is not, perhaps, generally known on this side of the Atlantic, that America has a flourishing organization known as "The Jet Pioneers' Association of the United States of America." The Association is holding its annual reunion next week, when the

FIRST SITTING: This air-to-air portrait of the English Electric P.1A—the first to be released for publication—shows the company's manager of flight operations, Roland P. Beamont, bringing the great fighter alongside a photographic Meteor. Beamont has been at the controls during most of WG 760's 100-plus flights (during nearly all of which supersonic speed was reached), but the present chief test pilot, Peter Hillwood, is now carrying part of the load. Incidentally, the P.1 was not fitted with afterburners when it became the first British supersonic aircraft.

celebrations will include the unveiling of a plaque in the General Electric works "at the site of assembly and test of the first jet engine in the United States." The unveiling will be performed electronically from a B-45 flying at 30,000ft.

Membership of the Association is open to "any person who contributed in any way towards the successful construction or flight of the original General Electric jet engine and was sworn to secrecy on such jet engine project prior to October 2nd, 1942."

As so often happens, it seems that in the formation of the J.P.A. American initiative has made a reality of something that has only been vaguely (if at all) considered in this country. When it is remembered that Sir Frank Whittle took out his first jet patent in January 1930, and had an engine running on April 12th, 1937, it appears remarkable that a comparable organization was not established here some time ago.

Two R.Ae.S. Honorary Fellowships Awarded

THE Royal Aeronautical Society announces the award of Honorary Fellowships to Mr. Igor Sikorsky, F.I.A.S., M.A.S.M.E., and Mr. H. Grinsted, C.B.E., B.Sc., F.C.G.I., F.R.Ae.S.

The former is, of course, the well-known pioneer designer of multi-engined aircraft, flying-boats, and helicopters; he is now visiting this country, and his lecture to the Institution of Mechanical Engineers is summarized on pages 591-592 of this issue.

Mr. Grinsted retired five years ago from the post of Director of Aircraft Research and Development at the Ministry of Supply. He had a distinguished career in aeronautical research, beginning when he joined the Royal Aircraft Establishment in 1912. In 1931 he transferred to the Air Ministry. Only 33 awards of Honorary Fellowship have been made in the whole history of the Society.

Yesterday, May 5th, Mr. N. E. Rowe was due to take office as president, at the conclusion of the annual general meeting. At this meeting the annual awards were made.

Helicopters and the Police

FOLLOWING recent references in *Flight* to the possibilities of helicopters for police work, we have been interested to see, in an issue of the half-yearly Police College magazine, an article on this particular subject. Written as it is from —presumably—first-hand knowledge of police requirements, it has points which deserve quotation here. Dealing first with traffic control, the author mentions the value of the helicopter as "a mobile operations room," for control of peak traffic near large towns or on special occasions. Contact would be maintained by radio with police cars, and with police on foot equipped with walkie-talkies.

We view with less favour the suggestion that dangerous driving could be detected from the air and that there might be legislation to make it compulsory for vehicles to display their registration numbers on their roofs. The author says that "the knowledge that police helicopters patrolled the area would doubtless have a sallutary effect on drivers and tend to reduce accidents." This may be so; but we cannot agree that an observer placed more or less vertically above the traffic is necessarily in an effective position to distinguish bad driving from good.

Turning to the subject of controlling disorderly open-air meetings, the article suggests that the appearance of a helicopter clearly marked "Police" would probably have a steadying effect, and it is suggested that use might be made of the "sky-shouting" technique.

Many applications are forseen for the helicopter in the prevention and detection of crime. As already proved in tests, it can track and pursue "wanted" vehicles, bringing police cars to intercept them, and it can also be valuable in searches for escaped criminals. A case is quoted, from America, in which a helicopter was used in a search for four escaped convicts: flying low, its crew scrutinized all the roofs, shores, docks and exposed areas of an island on which the fugitives were believed to be hiding; and it took only 15 minutes to perform a task that would have taken a squad of men 24 hours. The convicts, who had actually been hiding beneath the docks, said on capture that the presence of the helicopter had made it impossible for them to make a run for it.

The already well known applications of the helicopter in search and rescue work are quoted—the succour of persons swept out to sea in small boats, trapped by the tide, or injured on mountainsides—but other possibilities are put forward. For example, it is suggested that, in addition to landing medical aid at the scene of air crashes on mountains, a helicopter could, in the event of a night accident, act as a mobile floodlit-carrier during the initial rescue operations.

Aircraft Exports Fall

RECENT official figures show that United Kingdom aircraft exports for February last totalled £3,941,743, thus indicating a fall in comparison with the running monthly average of £4,581,090 for the previous 12 months.

The February export total was made up of complete aircraft to a value of £2,269,007; engines, £1,396,502; electrical equipment, £148,120; tyres, £37,455; and "instruments and appliances," £90,659.

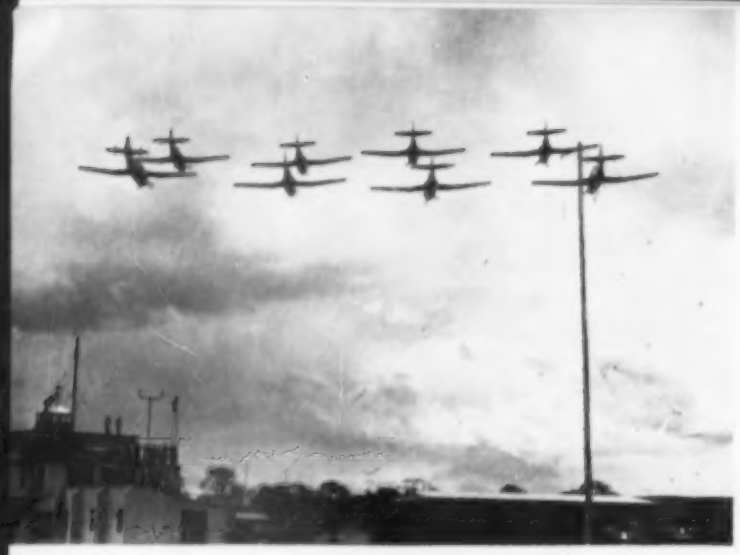
At £2,333,378, February aviation imports represented 59 per cent of the exports for the same period. During the preceding year the average proportion had been 42½ per cent.

Wall Street Sees a Threat

BRITAIN'S "battered aircraft industry" is intensifying its drive to wrest commercial air supremacy from American manufacturers, according to a recent article in the *Wall Street Journal*. The article—by a correspondent in England—said that the difficulties over the Comets and discussion of the high hopes held for the Britannia had obscured the success of the Vickers Viscount: "the Viscount, whose turbines spin four propellers, has snatched a remarkable number of sales from America's Convair 340, a twin piston-engined plane . . ."

The article continued: "Beyond this, two British aircraft engine manufacturers with alliterative names, Rolls-Royce and English Electric, are moving quietly ahead with plans to invade the inner sanctum of the U.S. airplane industry by getting their powerplants installed in American-built liners." [Mention of English Electric as engine manufacturers presumably implies the associated Napier company, the engine being the Eland.]

But the biggest challenge to American constructors was the Bristol Britannia, "a whale with wings." After discussing its possibilities on Atlantic services, the article went on to speak of the Comet 4, "whose jet engine would gobble up so much fuel" that it could not fly the lucrative London-New York route; nevertheless, Canadian Pacific Airways planned to buy "a substantial number" of Comet 4s for a London-Vancouver service over the North Pole route, extending to Australia by way of Hawaii.



A Coming-of-Age—with Gannets

ON April 26th No. 824 Squadron, Fleet Air Arm, based at H.M.S. *Gannet*—R.N. Air Station Eglinton, in Northern Ireland—celebrated its 21st birthday; and to mark the occasion the squadron demonstrated its new Gannet A.S.1s. No. 824 is not the first operational squadron to receive these aircraft, there being another Gannet squadron, No. 820, at Eglinton and No. 826 at Lee-on-Solent. The type is now in full service and proving popular with the crews. Within a wing span of 54ft and a length of 43ft a great quantity of electronic equipment, armament, fuel and engine has been disposed to produce an anti-submarine weapon of extraordinary potency. And the emphasis is very much on equipment rather than flying. The crews call it an observer's aircraft, and say that it is completely straightforward and easy to fly.

In welcoming the visitors to Eglinton, H.M.S. *Gannet's* commander, Capt. T. W. B. Shaw, D.S.C., R.N., said that the Gannet was part of an integrated force of air/sea weapons directed against the submarine, and that it marked a great advance in equipment. It had endurance, manœuvrability and a hitting power so far unequalled in such aircraft. When later we had an opportunity to see the aircraft and watch them flying it became clear what an immense task the development and preparation for squadron service must have been. They are extraordinarily well-packed weapons systems.

The squadron, which is commanded by Lt-Cdr. J. D. Honywill, R.N., celebrated its 21st birthday with a big party at which a 25-lb cake, surmounted by an excellent model of the Gannet, was cut by the youngest rating in the unit. No. 824 was formed before he was born. As is the case with many F.A.A. squadrons, the unit has been disbanded and reformed many times during its life; it first took shape in the amalgamation of two flights of Fairey III F spotter/reconnaissance aircraft in H.M.S. *Eagle* on the China Station in 1934. A year later it was re-equipped with Fairey Seals and straightway won a trophy for proficiency in high-level bombing; the award, a fine model of a Fairey Seal, is still in the squadron's possession. While detached to North Africa from *Eagle* during World War 2, all the pilots of a flight of three Swordfish were decorated for their action in destroying a submarine, a depot ship and a destroyer with two torpedoes, and a second submarine a few days later. The squadron also took part in the attack on Taranto. At the end of the war it was equipped with Barracudas and Fireflies.

Since the war the squadron has had Fireflies and Avengers and has taken part in many of the major exercises in both Home and Mediterranean waters. The first Gannet arrived on February 5th this year and was shortly followed by the remaining seven. All but two of the ten pilots made their first flight in the Gannet without first converting on the Gannet T.2, of which there are four at Eglinton.

On the morning of the birthday celebration the eight Gannets were lined up for inspection, with wings folded, and crested and numbered wheel-chocks in place. Soon the pilots climbed in and started up for a short workout on the ground. Getting into the Gannet is a most impressive procedure. Entry is from the starboard side, first up a short retractable ladder which folds out from the under-fuselage, thence up a series of recessed footholds to the front two cockpits, and over the wing and along further steps to the rear (telegraphist's) cockpit. The pilot's canopy can be opened from the ground by working a hydraulic hand-pump in the ladder-bay.

The starting procedure is complicated; it requires the firing of two Venom-type cartridges at the correct interval and the manipulation of engine controls in proper sequence, after which the second engine is started by windmilling from the first. There is a slight danger that the uninitiated might see a Gannet with one

Gannets in formation caught by the camera as they overtook a Naval Anson I close on the port side. Starboard engines' airscrews are feathered. One of the aircraft in the lower section is a Gannet T.2.

(Extreme left) With aircraft in finger fours and sections line astern, No. 824 Sqn flies past the tower at R.N.A.S. Eglinton.

(Centre) The "individualist" Gannets, during the demonstration, with radomes extended, are caught in the act of "feathering one."

(Right) The squadron's Gannets lined up with some of the air- and ground-crews. The spinners are painted maroon.

"FLIGHT" photographs

airscrew stopped and the other running, and walk into the danger area; he might mistake it for a single-airscrew machine since the noise of one engine is not very loud. The Gannet's piercing, harmonic, wasp-like sound does not make itself heard until both engines are running.

After the engines had all been started the pilots indulged in some amusing gymnastics, folding and unfolding wings, waggling controls, opening bomb doors and working the V.I. tailplanes. The radome cannot be lowered on the ground unless the aircraft is raised on jacks. All flying controls except rudders are spring-tab operated, and during ground-running at high power with wings folded the outer wing panels and ailerons flap somewhat in the slipstream. The nosewheel is not steerable, but the brakes appear very effective and the visibility is excellent.

There followed, after lunch, a flying demonstration in which eight Gannets flew past in close formation and two others showed the full range of configurations and speeds. One of them made a fast, low pass after a steep dive and appeared to be finding a good 300 kt, but the steepness of the dive seemed to indicate a mild shortage of power, and one presumes that, because of this, the full all-up weight potential of the Gannet is not yet usable.

In addition to Nos. 824 and 820 Squadrons, there are at Eglinton two training squadrons, No. 737 with four Gannet T.2s and Firefly 6s for pilot anti-submarine training, and No. 719 with Firefly 7s for anti-submarine observer training. With No. 824 there are two Australian crews which are to form the nucleus of the Australian Gannet squadrons which will embark for the return to Australia in the new R.A.N. carrier. No. 824 itself is due to carry out deck landing practice on H.M.S. *Bulwark* in June and go to the deck in H.M.S. *Ark Royal* in September. By then the unit will be fully worked up.

The Gannet T.2s of No. 737 Sqn. differ from the operational version mainly in the omission of the radome and the addition of flying controls in what would normally be the observer's cockpit. In addition, a periscope, which retracts when the front hood is opened, is added between the front two positions and the wiring and control trunk running aft beneath the cockpit coaming is to some extent deepened on the port side. The T.2 is still equipped for deck-landing and catapulting. A series of landings showed that the Gannet is quite indifferent to landing attitude, the legs being so disposed that a three-pointer is normal.

The Gannet is so intricate that the crews continue to find new tricks and habits for some time after converting, but the whole complex of equipment works most effectively.

(Right) A Gannet take-off: the white object half-obscuring the rear cockpit is a sheet of paper with which the telegraphist is shielding his radar scope.

(Bottom right) One of No. 737's Gannet T.2s taxies out with an airscrew feathered and instructor's periscope extended.

(Below) "Arms unbend . . . go": Gannet gymnastics in progress.

***ON THE LEVEL:** The Convair XFY-1 Pogo vertical take-off prototype, always a curious-looking machine, loses none of its grotesque character even when cruising in level flight. Powered by a 5,500 e.h.p. Allison T40-A-14 turboprop driving a contra-prop providing thrust greater than the all-up weight, the XFY-1 is being test-flown near San Diego.*

HERE AND THERE

The Duke at Aluminium Show

IT is announced that on June 3rd the Duke of Edinburgh is to visit the Aluminium Exhibition (June 1st-10th) at the Royal Festival Hall, London. Originally intended to be a "trade only" show, the exhibition is now to have facilities for public admission.

Lighter-than-air Encouragement

TWO awards are to be made by the Royal Aeronautical Society from the R.38 Airship Memorial Fund. They are to Lord Ventry, to assist him in his work with the airship *Bournemouth;* and to Mr. W. N. Alcock, to aid him in further airship investigations. The first award in the fund was made in 1923 and the last—to Mr. A. A. (now Sir Arnold) Hall—in 1938.

Defending the New World

THE civil-defence authorities of Canada and the U.S.A. are preparing a series of mock air raid exercises for this summer, to include the simulated use of nuclear weapons. Tests planned for the period June 15th-17th will involve a number of Canadian centres as well as some 50 U.S. cities, including New York and Washington.

Washed Out

THE great Red Air Force fly-past over Moscow's Red Square, in celebration of May Day, was completely washed out this year by continuous rain and low cloud. For some days beforehand Moscow radio had reported that "heavy four-jet bombers and transports" were practising for the occasion. In other Communist countries parades went ahead according to plan. Light aircraft were mainly engaged, but in Poland a "jet fighter built entirely in Polish factories" was seen. It is said to have been "carried in a procession" by aircraft fitters.

Drift to North America

VISITING Canada, Dr. Stanley Hooker, chief engineer of the Bristol Aeroplane Company, said in Montreal that the United States and Canada were taking away Britain's best aircraft designers and engineers. "We cannot afford to lose them," he said. "The United States in particular is getting too much of our best talent." The British industry would like to reverse the trend and get more Canadians to England. Some firms, including Bristols, were trying to even the balance by employing Canadians straight from universities, "but," said Dr. Hooker, "many of them usually return home after gaining experience which the British industry could use."

Mighty Dollars

FOR the year ended March 31st, 1955, sales of Glenn L. Martin products (which include the licence-built Canberra) amounted to a total value of $61,409,537, or over £22¼m.

For Photographers

ON May 18th *Amateur Photographer* is publishing a special number in connection with the British Photo Fair (New Horticultural Hall, Westminster, May 16-21). It will include a complete survey of the exhibits, and details of a £350 photographic competition.

NATO Commander Here

THE NATO Supreme Allied Commander, Atlantic, Admiral Jerauld T. Wright, arrived in this country last Friday for a stay of a few days. Immediately on his arrival he began a programme of visits, including informal discussions with the Chiefs of Staff "on problems of mutual interest". At Portsmouth he was meeting the Commander-in-Chief, Admiral of the Fleet Sir George Creasy, who is also the Allied Naval Commander-in-Chief, Channel, NATO. He was also visiting Coastal Command H.Q. at Northwood to discuss matters relative to the Eastern Atlantic Command with Admiral Sir Michael Denny and Air Chief Marshal Sir John Boothman, A.O.C.-in-C. of Coastal Command.

WORLD AIR POWER

NEXT week's issue of *Flight*, dated May 13th, will be a greatly enlarged special number dealing with the world's air forces and their aircraft. The organization of some 70 air forces will be described, and there will be some hundreds of photographs of their various machines. Another pictorial feature will illustrate aircraft markings. Data tables will also be given in reference to all types of military aircraft of any significance at present in service anywhere in the world. There is certain to be a heavy demand for this greatly enlarged issue, and we suggest that readers should place orders with their newsagents.

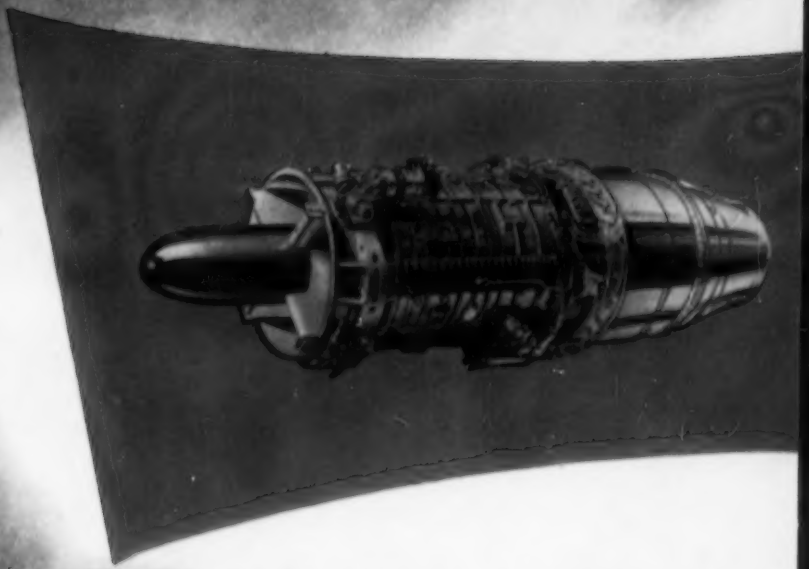
Canadian Farnborough

CONSIDERABLE progress is being made national Air Show to be held in conjunction with the International Trade Fair at Toronto. There will be an aeronautical static show in the Fair itself, where about 20,000 sq ft of indoor and outdoor space is available, and two days of display flying, on June 4th-5th, organized by the Toronto Flying Club. It is believed that almost the whole of the Canadian aircraft industry will support the Show, and there are indications that foreign countries—including France—may contribute exhibits.

***ROYAL VISIT:** As recorded last week, on April 22nd the Duke of Edinburgh visited the M.L. Aviation Co., Ltd., at White Waltham, spending several hours touring the factory. He is seen with (left) Mr. E. N. Mobbs, managing director, and (right) Mr. A. D. Scott, Mr. M. J. O. Labelle (chief designer) and Mr. M. R. Mobbs.*

The POWER of Armstrong Siddeley

Two Armstrong Siddeley Sapphire turbojets power the Gloster Javelin all-weather fighter. The Sapphire is the chosen power unit of no less than eleven fighting aircraft of the Western powers. Evidence of the almost universal power of Armstrong Siddeley aero engines.



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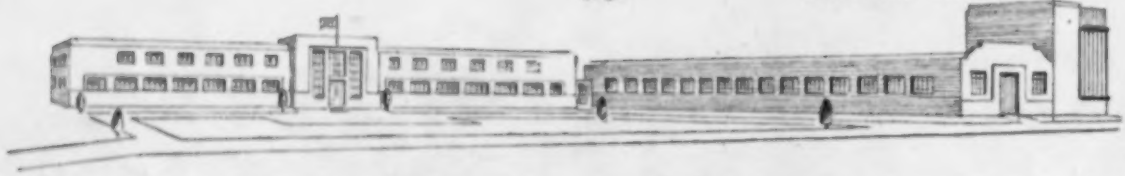

ACTUALITÉS FRANÇAISES

Part 3: Non-stop Variety in Light Aircraft

THIS is the third of C. M. Lambert's articles on a number of firms of the French aircraft industry and on flying experience with French light aircraft in particular; parts 1 and 2 appeared in our two preceding issues. The latter part of the present article, dealing with the Druine D.61 Condor, has been contributed by another author, who recently had an opportunity of flying this particular aircraft.

I SPENT the remainder of the week-end watching Jacques Noetinger and several other pilots in the final phases of a light aircraft competition from which might result a production order for a civil training aircraft and a four-seat club aircraft. The competition had started on February 27th with 18 types and by the week-end of March 20th the selection had been narrowed down to the Supercab, Jodel D.112, Druine Condor, Blairvacq-Piel Emeraude, Brochet M.B.120 and, in the four-seat class, the Boisavia Mercurey and Paul Aubert Cigale.

The evaluation of these aircraft was in the hands of five pilots, one from the Centre d'Essais en Vol, one from S.A.L.S. (Secretariat of Light and Sporting Aviation), M. Buisson, M. G. Rébillon (the Minicab record holder) and Jacques Noetinger. A technical commission of five was also investigating the engineering features of the aircraft and the final decision, on the basis of reports submitted, is being taken by the Fédération Nationale Aéronautique, which sponsored the competition.

On the Saturday the wind was too strong to achieve any worthwhile results and flying was postponed until the next day.

Buc and Toussus-le-Noble. I spent the Sunday morning with M. Hirsch at Buc, where S.N.C.A.S.O. has its helicopter training school. M. Hirsch has been working since 1936 on a most interesting project for aerodynamic gust-alleviation, and his ideas have at last borne fruit in the form of a small twin-engined aircraft. He is an extremely skilled technician as well as a pilot and after many years of careful experimental working he hopes now to be able to prove his theory in practice. He did not at the time wish to disclose the results of the 12 hours' flying so far completed; but when, in the near future, these are published, we hope to give details. The test pilot of the Hirsch aircraft is M. Buisson.

Incidentally, the hangar of the Piper aircraft agency for France is at Buc and close by the Hirsch prototype there is a number of Piper light aircraft including, at the time of my visit, one of the Apaches which Max Conrad has been delivering non-stop from New York. Next door M. Paul Aubert is building the Cigale, and the first Druine Condor side-by-side very-light low-wing monoplane was being repaired after a forced landing in which it overturned and was extensively damaged.

I talked for a while with M. Aubert and was shown how the Cigale is built; I saw as well the first of all the Cigales, a pre-war machine which, like its successors, has an unbraced high wing of partly elliptical plan form. This early machine once carried four people on the power of a 90 h.p. engine. M. Aubert is now considering offering the latest Cigale alternatively as a high- or low-wing cantilever monoplane.

Buc is, of course, practically contiguous with Toussus-le-Noble and there are actually six aerodromes in the immediate area—the two just mentioned and Billancourt, Villacoublay-Main, Villacoublay-Morane and Issy-les-Moulineux, not to mention the ramifications of Orly and Le Bourget. I was to spend the afternoon dashing furiously backwards and forwards in an assortment of aircraft between Buc and Toussus, but meanwhile the wind had again been too strong to permit any accurate tests on the series of light aircraft mentioned above and we all retired to the terminal building at Toussus for lunch.

Toussus is surely the Mecca of European light-aircraft exponents, and one cannot spend any time there without seeing this or that interesting aircraft or personality. I had lunch with, among others, Ingénieur Jarlaud, who designed the Air 100 and the Bréguet 901 gliders and who is now, apparently, engaged in the design of a stratospheric glider for high-altitude meteorological research; also present was M. Max Gasnier, who captained the French gliding team at the International Championships at Camphill last year. I heard from them something about flying, both

(Top) The Hirsch prototype gust-absorption aircraft in its maker's workshop. The wooden fuselage is exceptionally clean and the engine cowlings large enough to take more powerful engines. The variable-pitch airscrews are of M. Hirsch's own design. (Lower picture) The Brochet M.B.100 with Hirth 90 h.p. engine; this is an earlier version of the Continental-engined M.B.120 described here.

powered and otherwise, in the heavy turbulence of the mountainous regions of France. The normal criteria of lift and power just do not seem to apply when a machine is caught in some of the mountain downdraughts. Those Frenchmen who do fly seem to have a wonderful stock of amusing reminiscences and an extraordinarily varied series of aircraft in which to meet with their many adventures. The French enthusiast comes to know about a great number of light aircraft in the normal course of sporting flying.

The Brochet M.B.120-01. After lunch, when we hoped that the strong wind would moderate, Jacques and I began a series of flights, the object of which was the continuance of the light-aircraft competition. Our first mount was the little yellow Brochet M.B.120-01 (F-WGVI), a side-by-side two-seat high-wing monoplane with a Continental 90 h.p. engine. We took off from Toussus, flew around for a moment and then made two take-offs and landings from Buc, each of which was measured and timed by men standing beside the grass runway. The M.B.120—there are one or two other versions—is not over-exciting to fly; the controls are a little heavier than the Auster's, and it is in a few respects similar to it.

GY-30 Supercab. We left the Brochet at Buc and climbed straight into the GY-30 Supercab (F-BEPO). There are now three of these delightful little aircraft in existence, one of which belongs to M. Rébillon. It is powered by a Continental 90 h.p. engine, has mechanically actuated flaps, a mechanically retractable undercarriage, and a complement of instruments typical of light aircraft of this type, namely A.S.I., altimeter, V.S.I., a plain ball slip-indicator, r.p.m. dial and oil temperature and pressure gauges. The fuel gauge is a simple float which directly actuates a long wire probe projecting from the top of the tank just in front of the windscreen.

The Supercab is a remarkable aircraft, a side-by-side two-seater with a stalling speed a little under 60 km/hr (37 m.p.h) and a cruising speed of no less than 215 km/hr (134 m.p.h.). It is fully aerobatic, has the delightful controls which have become known as a trade-mark of aircraft designed by M. Gardan of S.I.P.A., and a rate of roll like that of a fighter. In fact, the Supercab is a miniature fighter and sheer joy to fly, even though it is just a little noisy and draughty.

We took off from Buc with a ten-second run and at 80 km/hr (50 m.p.h.), aircraft clean, 2,050 r.p.m., the initial rate of climb

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was 4 m/sec. (790ft/min). We wanted to see how long it would take to reach 1,000 m. (3,280ft) and made it in 8 min, 45 sec, passing the 600 m mark (1,960ft) in 5 min with a rate of climb of 1.5 m/sec (295ft/min) and 750 m (2,450ft) at 110 km/hr (68 m.p.h.) with 2.3 m/sec (450ft/min) on the V.S.I. The total time was not very good; we would have done better to keep to 110 km/hr all the way up.

After the climb we frolicked about a little, making one or two very rapid rolls at about 190 km/hr (119 m.p.h.). We then approached Toussus, joining the circuit as about number six to land, in a continuous stream of aircraft using the two runways, one tarmac and one grass, which lie side by side across the airfield. Lowering the undercarriage requires about 30 turns of the handle between the seats. We approached at 110 km/hr (68 m.p.h.), crossed the hedge at 90 km/hr (56 m.p.h.) and touched down, with little float, at 60 km/hr (37 m.p.h.).

The first prototype of the S.N.C.A.N. 856 N four-seater on the apron at Toussus-le-Noble; it is a club and glider-towing machine. The immediately lower view depicts the N.C. 856 N's cockpit. The instrument panel obtrudes into the line of vision far less than this view suggests, since the windscreen sweeps down and sideways round the narrow engine cowling. *"Flight" photographs*

Nord N.C.856N. Our next rendezvous was with the Nord N.C.856N (F-BHHC), a new four-seat version of the familiar twin-finned, shoulder-wing cabin monoplane formula which Nord has produced both for the clubs and in an A.O.P. version for the French Army.

Jacques was to fly this so that his photographer, M. Dengremont, could take air-to-air photographs of it from a Norécrin. Two of Jacques' relatives came with us to complete the full passenger load and we met the Norécrin about 2,000ft above Toussus. There we stooged down-sun while Dengremont wielded his camera and I retaliated as best I could with my Leica.

The N.C.856N is a rather intriguing aircraft. The sitting position for the pilots is very upright and the view over the nose exceptionally good, even though there is a 160 h.p. S.N.E.C.M.A.-Régnier 4L08 engine in the way. The windscreen curves down over the side of the cowling and from one's high perch one does not particularly notice the engine. The wing joins the cabin structure just about at eye-level so that, by stretching, one can see quite easily either above or below it. The high-wing monoplane's traditional blind spot is thus eliminated—a most useful feature in such crowded circuits as that at Toussus.

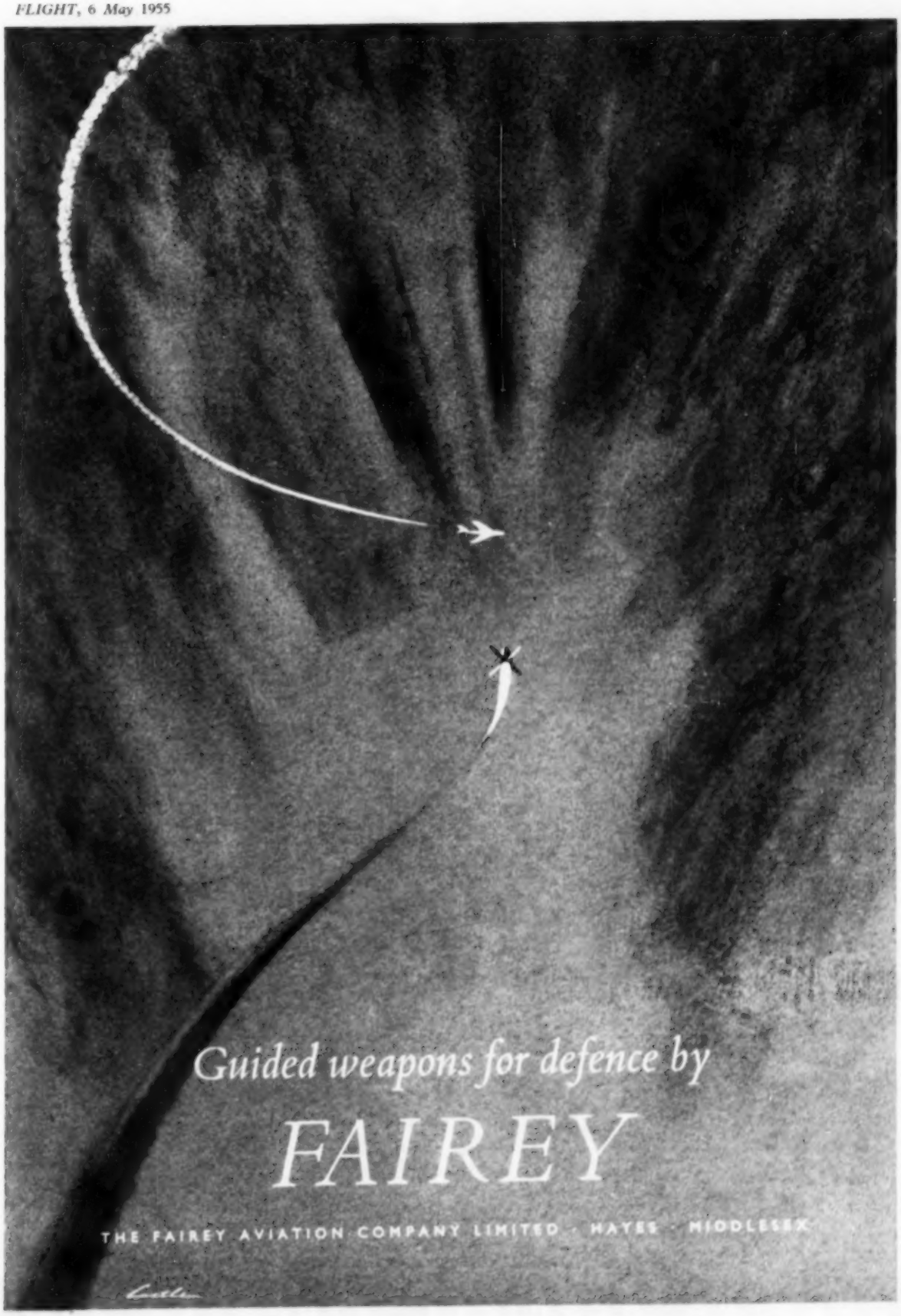
The N.C.856 is very much a steel-tube aircraft and apparently the rear passenger seats are not over-spacious. By English standards the engine instrumentation is comprehensive; it includes intake-pressure and fuel-pressure gauges. The elevator trim control is a lever which, projecting from the main panel, is moved up and down in the natural sense and is very effective.

The take-off, with four people up, took 7 seconds and we climbed away at 3.7 m/sec (730ft/min) and 85 km/hr (53 m.p.h.); when the flaps came up this was increased to 100 km/hr (62 m.p.h.) and 3.8 m/sec (750ft/min). We cruised comfortably at 180 km/hr (111 m.p.h.) and when I tried the controls I found them very firm and the aircraft very stable. It felt, in fact, like the ideal touring aircraft which could be left for long periods to fly itself "hands off." I was told that the stall is definite and rapid.

The final approach was made at 110 km/hr (68 m.p.h.) and touch-down at 80 km/hr (50 m.p.h.), the excellent visibility over the nose being particularly appreciated.

The aircraft was designed principally for club purposes—that is, as a rugged, simple machine, easy to fly and maintain, capable

(Bottom left) The biter bit: a quick Leica shot of the Norécrin from which the N.C. 856 N was being photographed over Toussus. (Below) The excellent little side-by-side Jodel D.111, identical in all respects but the engine to the machine flown by the author from Buc to Toussus; and, immediately below it, the first prototype of the Blairvacq-Piel CP-30 Emeraude which was entered for the competition mentioned here.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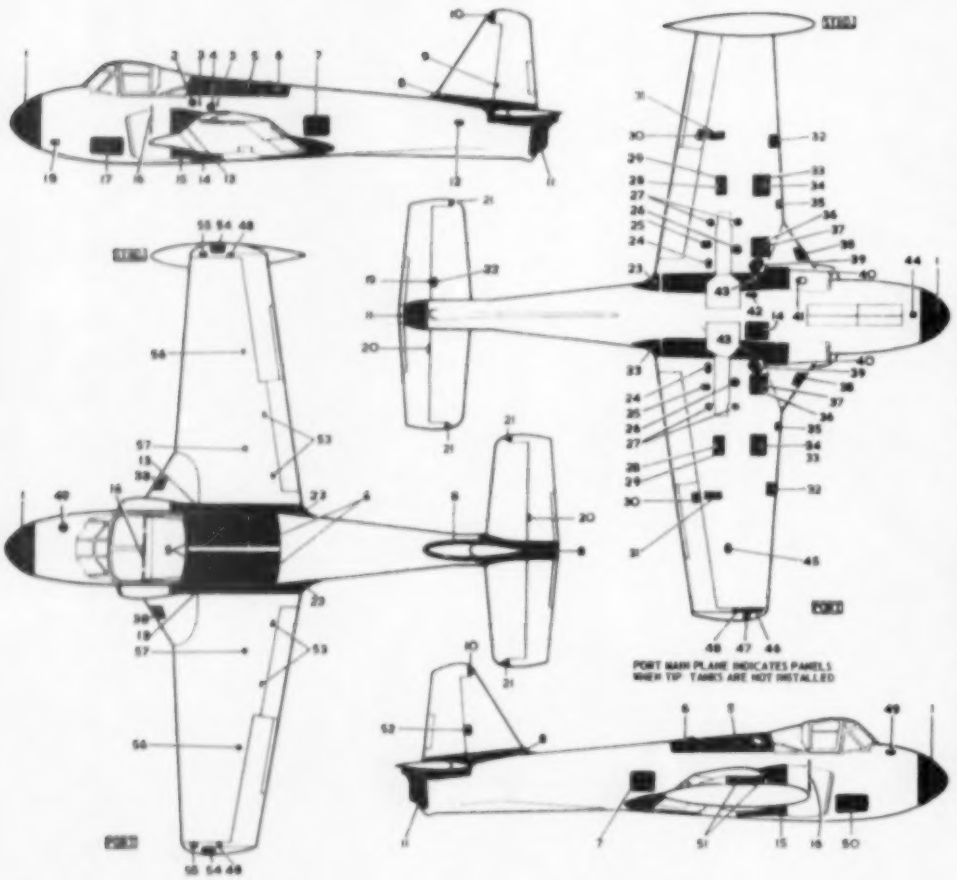

Item No.	Accessible components
1	BATTERIES, RADIO AND ELECTRICAL EQUIPMENT, HEATING SYSTEM, OXYGEN AND PNEUMATIC STORAGE BOTTLES
2	COMPRESSOR CONNECTIONS
3	GEARBOX ATTACHMENTS (FOUR OFF)
4	ENGINE/GEARBOX ALIGNMENT
5	POWER UNIT
6	POWER UNIT
7	FLYING CONTROLS, JET PIPE ATTACHMENT
8	TAIL UNIT ATTACHMENT POINTS, RUDDER AND ELEVATOR CONTROLS
9	RUDDER BALANCE TAB CONTROL LINKAGE
10	RUDDER MASS-BALANCE
11	JET PIPE THERMO-COUPLE ATTACHMENT, NAVIGATION LAMP CONNECTIONS
12	JET PIPE REAR SUPPORT, FLYING CONTROLS
13	ENGINE AIR-INTAKE AND PNEUMATIC COMPONENTS (IN PORT SIDE ONLY)
14	FLYING CONTROLS, ELECTRICS, PNEUMATIC PIPES AND FUEL SYSTEM COMPONENTS
15	FAIRING ONLY
16	ELECTRICAL EQUIPMENT AND ENGINE FIRE EXTINGUISHER BOTTLES
17	ELEVATOR AND TRIM CONTROLS, VACUUM PIPES, ELECTRICAL CONNECTIONS
18	EXTERNAL BATTERY PLUG
19	TRIM CONTROL ROD
20	CONTROL TAB LINKAGE
21	ELEVATOR MASS BALANCE
22	TRIM JACK
23	MAIN PLANE BREAK POINTS
24	FLAP OPERATING LEVER, JACK AND BALANCE CABLES
25	AIR BRAKE JACK AND BALANCE CABLE
26	UNDERCARRIAGE TORQUE TUBE ATTACHMENTS
27	UNDERCARRIAGE PIVOT BLOCK ATTACHMENT
28	NO.3 FUEL TANK CONTENTS UNIT
29	NO.3 FUEL TANK
30	AILERON TRIM AND BALANCE CONTROLS
31	AILERON CONTROL, OPERATING LEVER, STOPS AND TRIM JACK (PORT SIDE ONLY)
32	AILERON CONTROLS, WING-TIP TANK AND NO.2 FUEL TANK PIPING
33	NO.2 FUEL TANK
34	NO.2 FUEL TANK CONTENTS UNIT
35	AILERON CONTROL CABLES
36	NO.1 FUEL TANK
37	NO.1 FUEL TANK CONTENTS UNIT
38	TAXY LAMP
39	FUEL SYSTEM BOOSTER PUMP
40	FAIRING ONLY
41	FUEL SYSTEM INBOARD VENT PIPE
42	FUEL RECUPERATOR ATTACHMENTS
43	FUEL SYSTEM SERVICING COCKS
44	NOSE JACKING PAD
45	PRESSURE HEAD ATTACHMENTS
46	TIP TANK ATTACHMENTS
47	NAVIGATION LAMP AND CONNECTIONS
48	AILERON MASS-BALANCE
49	DE-ICING TANK FILLING POINT
50	ELEVATOR LIMIT STOPS AND ELECTRICAL CONNECTIONS
51	TIP TANK PIPE CONNECTIONS
52	FIN STRUCTURE
53	LIFT SPOILER CONNECTIONS
54	TIP TANK PIPE CONNECTIONS AND ATTACHMENTS
55	TIP TANK PIPE CONNECTIONS
56	AILERON OPERATING LEVER
57	UNDERCARRIAGE SHOCK-ABSORBER ATTACHMENT AND INFLATION POINT

PORT MAIN PLANE INDICATES PANELS WHEN TIP TANKS ARE NOT INSTALLED

Access panels

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ACTUALITÉS FRANÇAISES . . .

of operating from indifferent fields and suitable for what the French call *baptêmes de l'air*. A glider-towing hook is standard.

Jodel D.112. Having returned the N.C.856N to its owners, Jacques and I once more took to the Supercab. We flew back to Buc where the Cigale, with four up, was carrying out landing and take-off trials and, after a short frolic, we landed there. By this time, however, the competition was interrupted for a conference at Toussus and the Supercab and a Jodel D.112 had to return thither post-haste. Since I had not flown a Jodel before I took the opportunity of returning to Toussus in it.

There was no time for any of the normal formalities and the owner and I climbed in, started the Continental 65 h.p. engine, and taxied straight out. The D.112 was described fully in a recent article in *Flight* (April 8th) and my own impressions are principally a comparison between it and the Druine Turbulent, which I flew a year ago. We took off without any vital actions (none was needed) and climbed away at 3 m/sec (590ft/min). The visibility over the nose is excellent and the cabin comfortable and practically draught-free. There is even a heater, taking hot air from an exhaust-pipe muff.

An interesting feature of the Jodel is that the rudder need hardly be used at all, and properly co-ordinated turns can be made with the stick alone. The speed range is also quite high, from 165 km/hr (102 m.p.h.) cruising, at 2,000 r.p.m., to 45 km/hr (28 m.p.h.) stalling. The stall itself is completely viceless and results simply in a slight judder followed by a gentle dropping of the nose to a point just below the horizon. Hardly any height seems to be lost and lateral control remains throughout, because of the considerable washout on the upswept wing-tips. Visibility forwards—and, indeed, in every direction except directly backwards—is excellent in all flight conditions and while taxying. The trimmer is not particularly effective, nor is it really needed.

Since there are no flaps, the approach has to be made at the correct speed in order to avoid what could be a disastrous float. The final approach is at 80 km/hr (50 m.p.h.) and the touch-down at 50 km/hr (31 m.p.h.) and it is difficult to lose speed without gaining height and spoiling the effect. The only danger of a long float, of course, is that one might run out of field before one had succeeded in touching down. Once on the ground, however, the D.112 stops almost immediately and can then be driven about with the aid of the steerable tailwheel.

After putting the aircraft away in a hangar at Toussus, I talked for some time with the pilot and his brother in the basement bar of the terminal building. They and two friends had built three D.112s in five months, using a small section (about 38ft by 13ft, they said) of their father's furniture factory at Creil. When the light-aircraft competition was announced, the Jodel Company inspected all the D.112s so far built to find which most closely corresponded to the design performance, and they had settled on this one. The constructors—who looked to be under 25 years old—said it had cost them about £300 to build each machine. The total cost was 800,000 fr. (£820) per aircraft, divided as follows: Continental 65 h.p. engine, 415,000 fr. (£427); plywood, 60,000 fr. (£62); spruce, 25,000 fr. (£26); all other material and equipment, about 300,000 fr. (£310). But of such a total the French Government gives to any private club aircraft constructor or buyer 60 per cent of the cost of the engine and about 200,000 fr. (£205) per seat in the aircraft. Thus one of these ultra-light aircraft can be bought or built in France for a personal expenditure of about £300. Great economies can be made by using certain motor-car parts—particularly such things as oil pressure gauges, which cost about 1,100 fr. (£1 3s) for a car as against 11,000 fr. (£11 8s) for an aeroplane. For the undercarriage it is also quite feasible to use motor-scooter wheels.

There are two types of ultra-light airworthiness certificate in France, the C.N.R.A. (restricted) and the C.N.D. (international). The first calls for only two official inspections during construction—one when the aircraft is complete except for skinning, at which point the engine must be run, and the other a flight test during which the take-off and climb are measured. The engine is then sealed and the aircraft must complete five hours' flying with an experimental registration prefixed F-W. If then satisfactory, the machine is given a restricted certificate. The C.N.D. international certificate calls for inspection of each major component.

The young constructors from Creil were proud of their accomplishment in building three D.112s, and with good reason. The example I saw was excellently finished, and they had even gone so far as to decorate the dashboard with inlay work in three or four different types of wood veneer.

Their base of operations, curiously enough, is the secondary perimeter track of the jet-fighter airfield at Creil, and this has given rise to many almost insuperable problems since they have to deal not only with the local airfield circuit, but also with the Paris control area. But their troubles have now been resolved, and so long as they stick rigidly to their appropriate section of the crowded sky they are free to continue flying. One cannot but admire such skill and keenness.

The Druine D.60 Condor side-by-side two-seater 60 h.p. Continental described below. Jacques Noetinger—of the French equivalent of the S.B.A.C.—is at the controls.

FLYING THE DRUINE CONDOR

CONCURRENTLY with the growth of amateur aviation in France since the war there has been satisfying and steady development of aircraft for the sporting and touring pilot. In spite of many difficulties—notably the shortage of suitable "non-dollar" engines of about 65 h.p.—there are now at least eight types of light two-seater from which the intending owner can choose. Some are suitable for amateur construction; others are factory-made. The main support for the manufacturers has come from the amateur construction movement, and it is the spirit of self-help in this movement which characterizes light aircraft groups in France.

With the renewed interest in light aircraft in England, largely brought about by the recent establishment of a system of certification through the Popular Flying Association, plans are already in hand here for small-scale production of one or two existing French types.

One of the better known names in the field of French *artisanal* constructors and designers is Société des Avions Roger Druine of Paris. Roger Druine designed, built and flew his first aircraft at the age of seventeen. A simple, single-seat biplane, it is still flying today, seventeen years later. His post-war, single-seat Turbulent has been a great success, and it was with one of these that Roger Millicent, a member of the Cognac Aero-Club, flew from Cognac to Casablanca—a distance of nearly 1,000 miles—without incident. The Turbi, a two-seat version of the Turbulent [described in *Flight* on April 8th] is being widely built from sets of plans. Some six Turbis are at present being built by amateurs in this country under the aegis of the P.F.A.

The Condor, however, is not designed for amateur construction in the same sense as the others; proper facilities and a certain amount of skilled aircraft engineering ability are required. In the Condor, the designer has aimed at a first-class light aircraft with good finish and excellent flying qualities, though still at a reasonable price. This article concerns the prototype, but at least two have so far been completed. Granting of the French Certificate of Airworthiness was an almost accomplished fact at the time of writing, and a small production series has been begun to satisfy those clients who have already shown their confidence by placing firm orders.

The designation of the type varies according to its engine and equipment. The D.60 is the prototype fitted with the Italian CNA.D4 engnie, which is virtually a Continental 65 h.p. The production aircraft has the true Continental A.65 and is called D.61. The *de luxe* production version has the Continental 90 h.p. and is the D.62. Addition of V.H.F. modifies the type number to D.620.

I recently examined the D.60 at Buc, the old Blériot airfield near Paris; and if the spirit surrounding the light-aircraft activities there is anything to go by, the traditions of the pioneers of this place have not been forgotten. Lunch with the local types in a nearby eating spot, where aviation has been a by-word for nearly 50 years, is an enlightening experience. Here is enthusiasm of a type rarely seen in this country these days, and a spirit which would cause many of the applicators of delegated authority to expire with horror.

Fortunately the day chosen for the examination of the Condor could not have been better, and while Roger Druine busied himself preparing the trim little aircraft for flight it was possible to study the constructional features.

The mainplane is a low-wing cantilever structure of trapezoidal

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form with wing-tip fairings of balsa. It comprises 24 ribs and two spars, the main spar being of box type with the rear face located at 30 per cent of the chord. This line is the basic datum for the construction of the mainplane. The rear spar consists of two flanges with a gaboon plywood web while the front spar has two flanges of decreasing thickness towards the tips. The front spar webs are in both birch and gaboon ply. Two ribs on each side are reinforced to carry the aileron hinge brackets, which are of tubular construction and have ample bearings in bronze. The ailerons themselves are of slotted type and operation is by means of an adjustable push-rod actuated by a differential control mounted on ball bearings and operated by cables; turnbuckles for adjustment are located under the seat, at the base of the control column. The root ribs are boxed and carry the control cable pulleys and safety-belt attachments.

The leading-edge covering is entirely of birch plywood in varying thicknesses. A stiffening-strip reinforces the wing structure outboard of the footwalks. Structure aft of the 30 per cent chord line is fabric-covered while the ply skin is covered with a lighter fabric thus giving a durable finish.

The undercarriage attachment is to two special ribs which form part of the leading-edge box, this method tending to limit the damage resulting from an unusually heavy landing. The undercarriage is of the single-leg type, the joint to the wing being by three substantial bolts. Shock absorption is by a simple pile of rubber interspersed with aluminium washers around a centre tube; a conventional compass-type tracking arm maintains the correct alignment of the wheel assembly. The wheels are fitted with mechanical brakes, operated from pedals located between the feet of the occupant of the left seat.

The tailwheel assembly, mounted forward of the sternpost, is fitted with a wheel of approximately 5in diameter, centred by means of bungee cord accommodated within the fuselage. The shock-absorbing medium is a spring, covered by a rubber bellows-type gaiter.

The fuselage structure is a wooden one, comprising two flat sides united primarily by the engine bulkhead and fire-proof panel; the main bulkhead for the wing attachment; the locker, with the first part of the fuselage rear decking; and the sternpost and fin spar combined. The longerons are of spruce, with the skin covering in birch and gaboon plywood. The whole is covered with light-grade fabric doped on and finally painted.

Cabin shape is given by a light-gauge steel-tube welded structure, the windscreen—made in one piece without moulding—being set at a slope which permits, even on the ground, full forward vision. Particular care has been given to the problem of rear vision, the cabin being fitted with two ample panels of Plexiglas ensuring a 360-deg visual range in flight. The doors open upwards, and the edges are fitted with flexible tubular cushioning to prevent the entry of slipstream, water and noise. Dunlopillo is employed for the seat upholstery and the seat backs are adjustable on the ground. Two suitcases measuring 36in × 18in and of average thickness can be carried in the luggage locker. The whole cabin is pleasantly trimmed in a durable grey crocodile-finish plastic.

The tailplane is in one piece, completely ply-covered and then covered in fabric in the same manner as the other main structure. Its framework is formed by two I-section spars and simple ribs with ply web, and the elevator is attached at three hinge points, the pins picking up in bronze bushes.

A trimming tab incorporated in the starboard elevator is operated by a Bowden-type cable which ends at the control knob located in the centre of the cabin roof. Fin construction is identical with that of the tailplane and integral with the fuselage, while the rudder is of similar construction to the elevator and likewise is fabric-covered.

Following a close examination of the Condor, and with the prevailing superb weather, any delay in being airborne would have been time wasted; so, after I had heard a brief description of the cockpit from M. Druine, the little engine was started and the cockpit tried for size while warming up. One pleasant feature is the lack of static friction in the control circuits; in fact, it was quite unusual for a light aeroplane to have such good characteristics in this respect. The side-by-side seats are very comfortable and the cabin has a satisfying depth about it, with plenty of room for big feet. The central control column (with extensions) is in the right position and makes entry, particularly for the skirted sex, much easier than usual.

Rudder pedals are similar to those of the Auster, with ingenious toe-operated brake pedals fitted in the port-side set. The cabin top is neatly made and the side panels hinge upwards very simply; as stated above, the view is exceptionally good, particularly to the rear, and there is plenty of headroom. Ventilators are fitted in the roof panel at the after end, while a trimmer control knob moving fore and aft in a slide, is mounted at the forward end for elevator trimming. Like several other French aircraft, the Condor has no direct vision panel or sliding window. Instruments are well laid out on the centre of the panel and covered with a light alloy flanged cover to hide all the various screws that mar so many light aircraft installations. A sharp edge on the coaming seemed just the thing to leave a trademark on the pilot's face should the aircraft decelerate quickly, but this is being altered in the production aircraft.

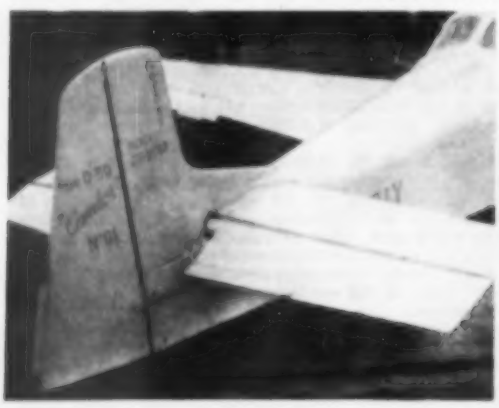
Taxying is very smooth and positive, without any need to use the brakes, and small figures-of-eight were made with ease on the tarmac apron in front of the hangar. Opening up to full power on the tarmac the Condor was airborne in a short distance, taking about seven seconds to unstick and climb away smartly, the time from ground level to 1,000ft being approximately 1 min 30 sec, with two up.

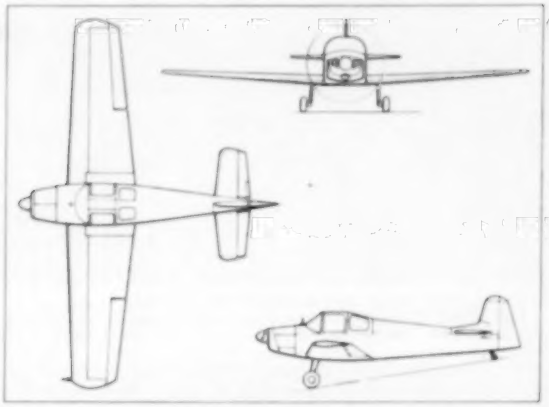
With the aircraft trimmed into level flight at cruising r.p.m. of 2,200 in calm air, the A.S.I. (with a wing-tip pitot head) was showing 160 km/hr (100 m.p.h.) while at full power the I.A.S. was 180 km/hr (112 m.p.h.). The controls felt most pleasant—particularly the ailerons—and the general feel of the aircraft in flight inspired confidence. The trimmer was adequate for all conditions of flight and hands-off flying seems to be the normal method of travelling.

The design of the controls has obviously been well thought out, and checks on stability gave good results. The longitudinal stability in the climb was positive; setting the speed a few miles per hour either above or below the trimmed climb speed resulted in the nose pitching in a gentle oscillation which damped out. In level flight short-period oscillations caused by sharply deflecting the controls and leaving them to their own devices showed all controls to be heavily damped, particularly the ailerons. At 70 km/hr (44 m.p.h.), which is about the take-off safety speed, the elevator control was adequate to pitch the aircraft following a simulated engine failure.

At all speeds upwards from 70 km/hr, normal manœuvres were perfectly straightforward and pleasant. Turns up to nearly vertical, feet off, with rapid reversals into the opposite turn, were possible without slipping in. A simulated baulked landing with

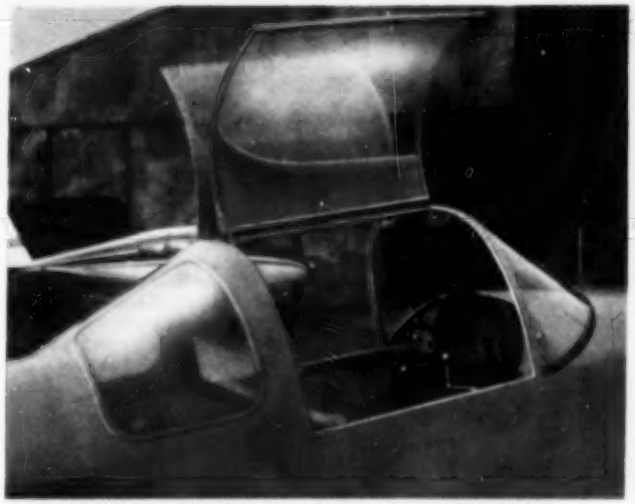
The tail of the Condor is characteristically marked with the name of the manufacturer, and the type number, type name and serial number. (Right) The first prototype outside the hangar at Buc.





Leading data, Druine D.61 Condor.—Span, 30ft; Length, 23ft; height (tail down), 5.1ft; wing area, 136 sq ft; aspect ratio, 6.8; empty weight, 663 lb; total weight, 1,140 lb.

	Continental A.65	*Continental 90 h.p.*
Maximum speed	112 m.p.h.	127 m.p.h.
Cruising speed	100 m.p.h.	124 m.p.h.
Stalling speed	38 m.p.h.	39 m.p.h.
Ceiling	14,000ft	18,500ft
Range	410 miles	435 miles



The Condor's hood opens upwards for easy access, and the rear windows afford an ample view aft. Note the neat instrument panel.

hands and feet off showed that under sudden application of full power there were no untoward trim changes. Sideslips at about 1.3Vs to the right and left showed plenty of rudder control available and releasing the controls in a side-slip resulted in the Condor's smartly going back to level flight.

With power off, there was no stall to speak of, and aileron control remained very good to the last moment, while with power on the attitude was almost ridiculous, the controls still being positive. A full series of stalls was not undertaken, but the results obtained were promising. The controllability characteristics result in good behaviour on the approach glide which can be steepened at will by side slipping, there being no flaps. Side slips were held on the glide and the nose wandered into a turn only with the bank being held on excessively. Touchdown in a light cross wind proved firm and positive and good for the vanity being without kangaroo's muscles in the undercarriage.

The immediate reaction to flying in this aircraft was quite anti-social; registration letters and serial numbers, however, prevented any kleptomaniacal tendencies.

While helping Roger Druine put the Condor into its hangar in company with the transatlantic Conrad Piper Apache, it was easy to appreciate, watching his careful attention to little items of maintenance, how good aeroplanes can be produced and also how future good engineers and designers can obtain that little something which helps them produce good and practical aeroplanes. A proper philosophy applied to light aircraft in this country could even now be a great help to our aviation in other spheres.

H. B-D.

THE AERONAUTICAL BOOKSHELF

"Faith, Hope and Charity," by Kenneth Poolman. William Kimber and Co., Ltd., 46 Wilton Place, London, S.W.1. Illustrated. Price 15s.

HERE is a real collector's piece—the true and factual history of three of the most famous aeroplanes of World War II, told by an author who appreciates the enthusiast's interest in details.

Mr. Poolman has gone to an immense amount of trouble to make as complete as possible his story of the three Gladiator biplanes that defended Malta in the summer of 1940. There is even a brief history of the development and service career of the Gladiator, which explains how Sea Gladiators N.5520, N.5519, N.5531 and N.5524 happened to be in crates at Kalafrana in April 1940.

It was the C.O. of Kalafrana, W/C. Michie, who first thought of uncrating the aircraft and forming a Station Fighter Flight at Hal Far. They were assembled by the Aircraft Repair Section, under F/O. Collins, and manned by seven volunteer pilots.

Ten days later the Admiralty remembered its Sea Gladiators at Malta and decided to send them to Alexandria. It looked as if the island would have to give up its sole defence against almost certain attack by Mussolini's Regia Aeronautica. Carefully, Collins and his men dismantled and packed the Gladiators back in their crates. Just as they were wearily securing the last box, Collins was called to the telephone. It was Michie: "Unpack the lot again and get 'em back to Hal Far as quick as you can. The A.O.C. has got permission to keep them after all and they look like being needed any time now."

They were. On June 10th Italy entered the war. Next day the Italian Air Force attacked Malta eight times, expecting it to be undefended. Startled by the Gladiators, they sent escorts of C.R.42 and Macchi 200 fighter with their bombers: but before the day was out, *Faith*, *Hope* and *Charity* had made their first kill. (There were originally *four* Gladiators, but only three were flown at any one time, so only three names were given to them.) The odds were apparently hopeless; but the Gladiators' manœuvrability, the soundness of their pilots' R.A.F. training and the devotion of the ground crews kept alive Malta's air defences, which were supplemented by the first Hurricanes at the end of June.

The Gladiators fought on for many months after that, side-by-side with Hurricanes, Fulmars and, finally, the Spitfires that saved the island when the *Luftwaffe* arrived to stiffen Mussolini's faltering attack. Indeed, in January 1941, the two surviving Gladiators were still so full of fight that they were nearly put aboard the badly damaged H.M.S. *Illustrious*, to protect her during her dash from Malta to Alexandria. Fortunately, the ship's captain decided that his vessel was a moving target, whereas Malta was not, so that its needs were greater than his.

Eventually only one Gladiator remained serviceable: but the other was again rebuilt, with an aircrew from a different aircraft, two extra guns above its top wing and other "mods" which earned it the nickname of "The Bloodiator." Even when the siege was raised and Malta had grown fat with whole wings of Spitfires, a lone Gladiator remained in use for meteorological reconnaissance.

It is her battered fuselage that remains today in Malta as a reminder of how four old biplanes and seven pilots once challenged an air force and saved an island, without which victory would have been difficult or even impossible.

"U.S. and Canadian Military Aircraft Recognition," by John W. R. Taylor. Ian Allan, Ltd., Craven House, Hampton Court, Surrey. Illustrated. Price 2s 6d.

BULKING larger than any other volume in the valuable series to which it belongs (*Civil Aircraft Markings*, *Civil Aircraft Recognition*, *British Military Aircraft*, *Continental Military Aircraft*), this little book offers salient particulars, photographs and three-view silhouettes of the many and varied aircraft which equip the U.S.A.F., U.S. Navy, U.S. Marine Corps and Coastguard, and the Royal Canadian Air Force and Navy. For good measure Mr. Taylor includes the latest U.S.A.F. guided-missile designations. At half a crown the book is quite remarkable value.

"Come Gliding With Me," by Ann Welch. Frederick Muller, Ltd., Earls Court Gardens, London, S.W.5. Illustrated. Price 9s 6d.

NO gliding enthusiast needs an introduction to Ann Welch and, such is her achievement in the sport, few would decline to come gliding with her. This book, however, is not for the established enthusiast, but for the enquiring young person who wants to know what gliding is and what goes on at a gliding club. This it explains in a fresh and clear manner, starting with a visit to Lasham and continuing through elementary gliding, cross-country soaring and a useful chapter on the weather, to championship flying. If put in the hands of normal schoolboys and girls at an appropriately receptive age, Mrs. Welch's book should guarantee an ever greater flow of recruits—with high chances of becoming converts—to engineless aviation.

JET PROVOST

Hunting Percival's New Ab Initio Trainer

AS far as possible, the Hunting Percival Jet Provost is just what its name implies: a standard piston-engined Provost redesigned for jet power. As such, it is—in its present form, at least—something of a compromise; yet the whole design has been most carefully formulated and deliberately executed in order to provide, quickly and cheaply, what seems to be close to the optimum military *ab initio* training aircraft.

The whole subject of Service flying training is today evoking considerable argument, not only on the score of the syllabus but also upon the types of aircraft which are required in order to train a given sort of pilot in the most efficient manner. The *raison d'être* of the Jet Provost is, therefore, of unusual interest, and general discussion of this nature has been deferred until after the straightforward description of the present design. This description, which follows immediately, applies to the second and subsequent machines of the service-test quantity now being built. The first aircraft (serial number XD 674) differs in detail, these differences being noted where they apply.

The Jet Provost is an all-metal, stressed-skin aircraft, powered by an Armstrong Siddeley Viper 101 turbojet and seating a pupil and instructor side-by-side in the nose. The airframe is quite conventional, and is based upon that of the Provost T.1, which was fully described in our issue of May 4th, 1951.

Compared with the earlier machine, the wing of the Jet Provost is modified principally to accommodate additional tankage and the legs of the retracted main undercarriage units. Port and starboard wings are each joined to the fuselage side, and each consists of a relatively highly loaded torsion-box leading edge structure, extending chordwise to the main spar at the rear, to which is added the remainder of the wing back to the subsidiary (rear) spar. This latter member is the rear boundary of the wing structure proper, and to it are attached the flaps, ailerons, spoilers and air brakes. Each wing is completed by the addition of the built-up metal tip, attached by Parker recessed screws.

The main spar, which is situated at the point of maximum depth at 35 per cent chord, is stronger than is that of the Provost in order to accommodate loads from high load factors combined with greatly increased indicated air-speeds. The spar comprises a sheet web, stiffened by vertical angle-sections, and upper and lower booms. The latter are machined extrusions from the root to outboard of rib 101.5, where a butt-joint carries the loads into a Z-section pressing which extends to the tip. The root ends of the two spar booms in each wing incorporate the main attachment points to the carry-through structure in the fuselage. Each attachment consists of a fork-fitting on the carry-through structure into which is inserted a machined lug at the end of the boom, in the vertical plane on the upper boom and horizontal on the lower, the wing being secured by large-diameter steel pins locked by an annular ring retained by a through-bolt and castellated nut.

The subsidiary spar is built up entirely from sheet or strip. It is locally modified or reinforced to accommodate hinges or jack attachments, and reinforcing strips and a bolted doubler-plate are provided at the root-end, where the spar terminates in a steel-bushed steadying attachment to the fuselage. Wing ribs are simple pressings, joined by angle brackets to the front and rear faces of the main-spar web. The rib peripheries are notched to accommodate spanwise stringers, which are generally of Z-section, although top-hat sections are used in the tank bays.

A feature which, although now standard, was only added to XD 674 during its flight trials is the triangular area riveted to the leading edge root on each side of the aircraft. These swept-forward root portions are fitted at a negative angle of incidence, and they have been found efficient in improving behaviour, particularly at high angles of attack. They incorporate the fixed taxying lights.

Except for a proportion of Pop-riveting on the underside aft of the main spar, the wing skin is flush-riveted. The other units associated with the wing (control surfaces, tankage, and the like) are discussed in later sections.

The fuselage is, unlike that of the Provost, built in two parts: a front section terminating at frame 83* (near the trailing edge), and a rear section aft of this point. In practice, three separate jigs are used, the nose and cockpit being made in a separate jig from that used for the centre (engine-bay) section.

The extreme nose is a hinged metal assembly covering the radio and batteries. The remainder of the front fuselage is made in the following manner: a rigid bottom section is built in a jig and used as a basis for locating transverse frames; pre-assembled port and starboard side panels are then attached; the nose section, forward of the cockpit, is riveted on; and the structure is completed by the attachment of the canopy, air intakes and top decking. The bottom section includes the cockpit floor, which extends back over the wing carry-through structure to form the floor of the engine-bay.

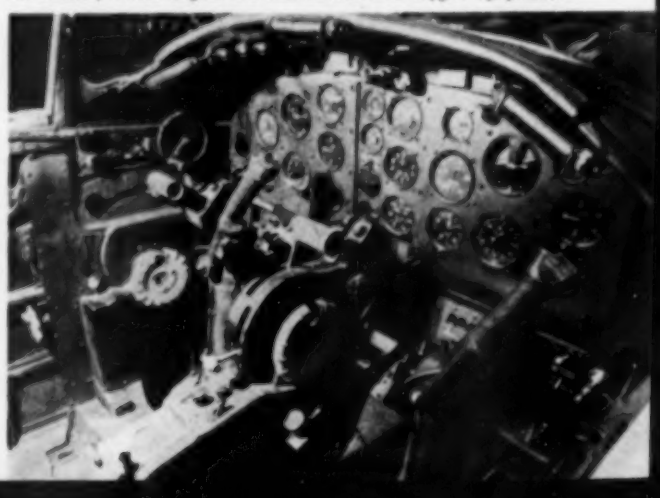
The cockpit is unpressurized, and the interior layout and equipment is discussed later. The canopy is very similar to that of the Provost, comprising a fixed built-up windscreen, a sliding hood and a fixed rear portion. Aft of the cockpit is the engine bay which, owing to the small diameter of the powerplant and the fact that side-by-side seating has resulted in a cockpit width of 45in, is quite exceptionally roomy. The engine is mounted on a secondary structure of steel tubes, as described in the section dealing with the power unit. The top of the engine bay is covered by four non-structural access panels hinged to a longitudinal beam along the upper fuselage centre-line. This beam can be removed before powerplant changes, and its forward end is attached to a strong triangulated structure, which forms a crash pylon behind the pilots' seats.

Major loads in the fuselage are taken by four main longerons, assisted by the longitudinal beam on the upper centre-line and a pair of keel members, the webs of which extend in depth from the cockpit/engine-bay floor down to the outer skin. These main members are supplemented by channel-section frames and Z-section stringers, the frames being notched to accommodate the stringers and longerons.

The rear fuselage is a straightforward semi-monocoque, built in six portions which are attached to each other before the whole assembly is offered up to the front fuselage at frame 83. The structure resembles that of the rest of the fuselage, with the addition of a jet-pipe rail along the roof, formed from back-to-back channel sections, and a similar pair of back-to-back channels along the bottom centre-line to increase the local stiffness. The extreme rear end is a separate section containing three double frames to which are attached the fin and tailplane. On XD 674 this section was of a different form from that now standardized. On the underside of the fuselage is a folded-sheet underfin, extending from near the wing trailing-edge to the extreme tail where it terminates in a steel-shod bumper. This has fully compensated for the considerable side-area forward.

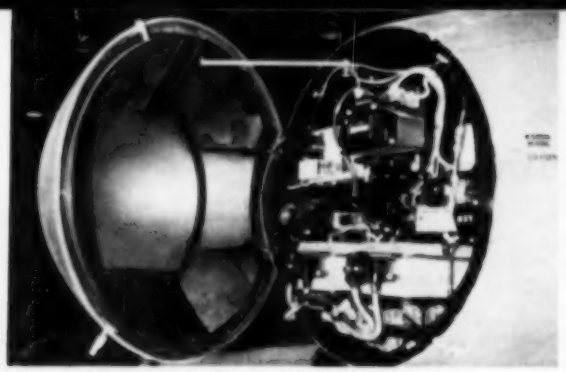
The tail unit is, both structurally and aerodynamically, almost identical with that of the Provost. The construction, which is quite simple, is well shown in the main drawing; all fixed and movable surfaces are two-spar, all-metal structures, with top-hat or Z-section stringers, pressed ribs and a sheet covering. The inter-spar skinning of the movable surfaces (elevators and rudder) is—like that of all Hunting Percival production types—fluted for added rigidity. The fin is pin-jointed to the fuselage at fore and aft fork-fittings, and the two tailplane spars are each attached

The cockpit of the Jet Provost, while closely resembling that of the piston-engined Provost, has a number of additions. These include a Machmeter, revised engine and fuel controls and oxygen equipment.

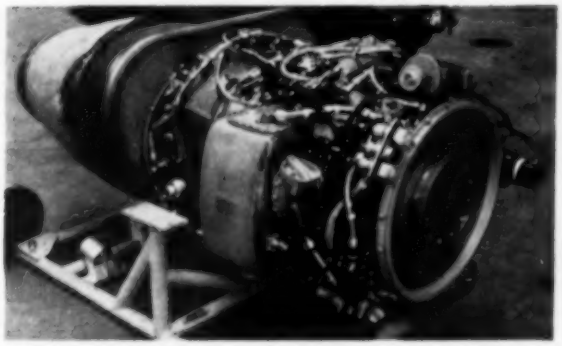


**The fore-and-aft datum in the Jet Provost is a flat-headed spigot, marked to this effect, on the underside of the fuselage, roughly 20in ahead of the normal range of c.g. positions. All fuselage frames are designated according to their position with respect to this datum.*

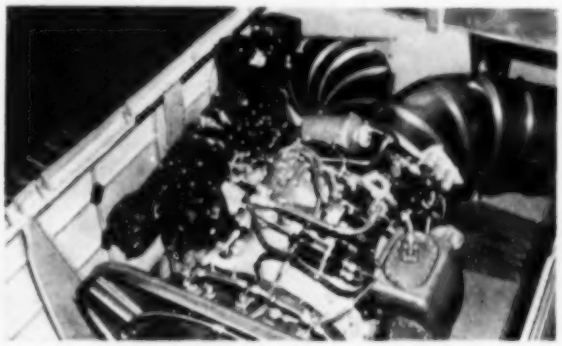
On the second, and subsequent, machines, the undercarriages and door geometry is as shown here. Also visible is the boundary-layer intake.



The nose hinges open for access to the radio equipment, batteries and other units. These can all be reached by a man standing on the ground.



The Armstrong Siddeley Viper 101 is supplied as a compact engine-change unit, with engine accessories and oil tank. Diameter is 28 in.



This view emphasizes the unusual amount of space in the engine compartment. The Rotol gearbox (left) is fuselage-mounted.

to two fork-fittings on the strong frames mentioned earlier.

The Jet Provost undercarriage is quite different in geometry from that of the piston-engined Provost, although the main legs are related. These units retract inwards, the wheels being housed in the fuselage between the spar carry-through members. The nose undercarriage retracts backwards. All undercarriage bays are fully faired by doors, the actuation of both legs and doors being effected pneumatically. Dunlop pneumatic equipment is employed throughout.

The main legs—which, like the nose leg, are British Messier products—are oleo-pneumatic units carried in cast tubes pivoted to trunnions bolted to the wing. The retracted legs are faired by doors carried by the legs themselves and the wheel bays are covered by separate doors which are operated by individual jacks and are, when open, restrained against flutter by bungee cord. The main wheels, tyres and brakes are all by The Palmer Tyre, Ltd., the tyres having an inflation pressure of 64 lb/sq in and the toe-operated brakes being of a recent single-disc design operating at 180 lb/sq in pneumatic pressure.

The nose leg is attached to the aircraft by means of a large, webbed housing which is pivoted to blocks in the forward-fuselage underfloor structure. The leg is retracted into a long bay between the fuselage keel webs; on XD 674 this bay was faired by port and starboard doors attached to the fuselage and a third door hingeing with the leg, but the current arrangement is to have four doors, all hinged to the fuselage. Another difference between XD 674 and its successors is that the earlier aircraft was fitted with a nose undercarriage which could be steered from the rudder control circuit. It has been found, however, that steering control is wholly adequate on the rudder and/or differential brakes, and the nose gear is now equipped only with an anti-shimmy and self-centring device. The tyre, inflated to a 60 lb/sq in, is a Palmer twin-tread pattern.

The flying controls are conventional surfaces, manually operated *via* a cable and tie-rod system by either pupil or instructor. The dual cockpit controls comprise longitudinally adjustable rudder bars and control columns pivoted for elevator control and provided with swinging pistol-grip tops for aileron movement. The control circuits themselves consist of 25-cwt flexible steel cables and light-alloy tie rods. The circuits are all locked by a lever on the main cockpit pedestal; this lever also closes the isolating valve in the pneumatic system and restricts the available range of throttle movement.

Ailerons, elevators and rudder are all attached to the remainder of the airframe by two inset hinges on each. All surfaces are metal-skinned, the rudder and elevator skinning being stiffened by chordwise flutes. Mass balancing for each tail control surface takes the form of steel bars mounted in a forward-projecting structure which forms the tip of the leading edge. In the case of the ailerons, a similar structure houses a cast-lead mass, additional lead washers being used for fine adjustments. Both ailerons are fitted with tabs, that on the port surface being a combined balance and pilot-operated trim tab, and the other being a balance tab only. The reverse is the case with the elevators: a combined balance and trim tab is fitted to starboard and a balance tab to port. (Apart from this different tab function, port and starboard elevators are identical and interchangeable.) The rudder is fitted with a balance tab only; this is a departure from Provost practice, the piston-engined machine having pilot-operated rudder trim.

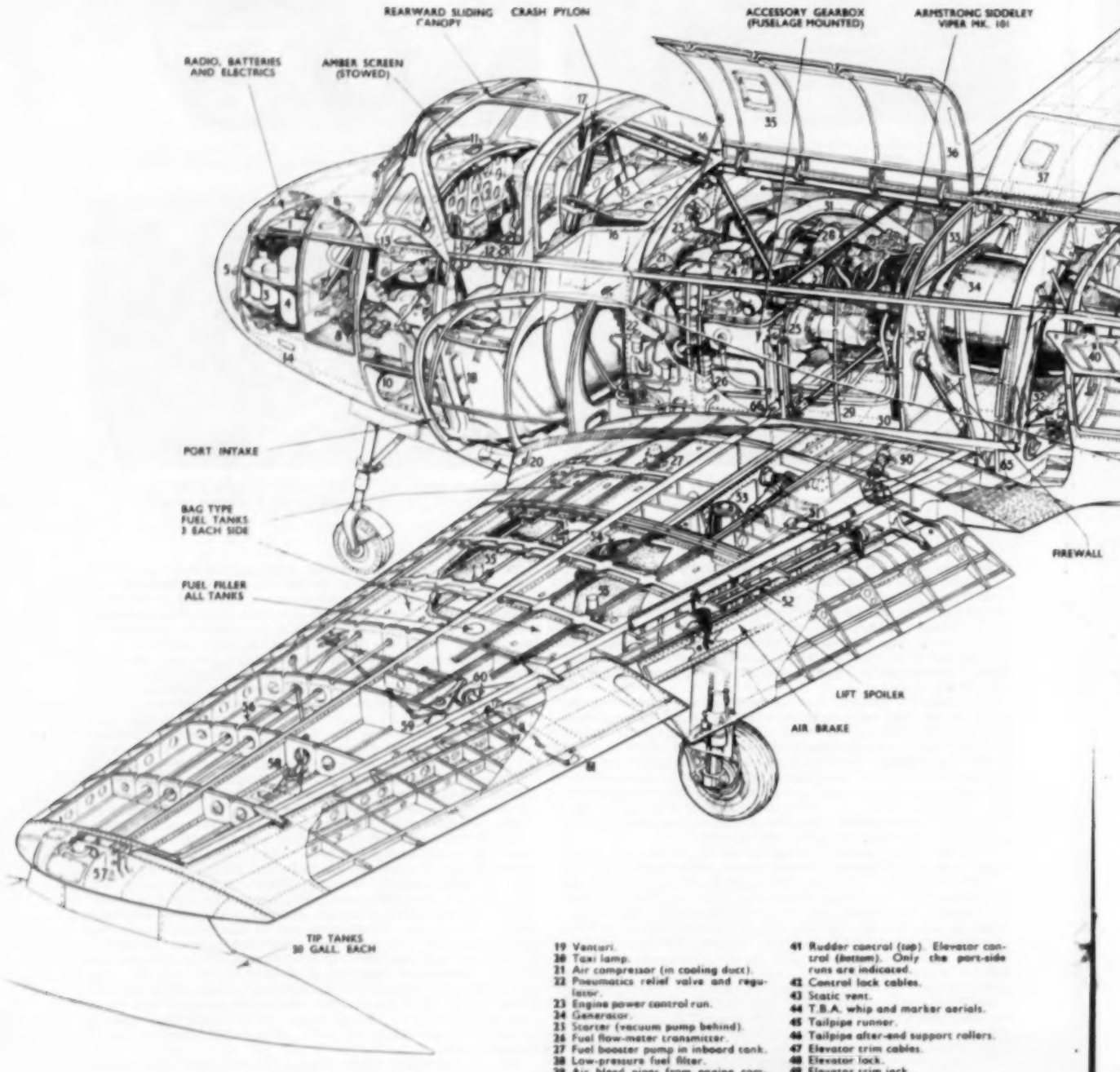
Each wing carries a single slotted flap on a pair of hinges extending from behind the subsidiary spar. The flaps are operated by double-acting pneumatic rams which are linked to the flaps *via* bell cranks, the latter being connected, port-and-starboard, by cables to maintain synchronization across the aircraft. The flaps are controlled by levers duplicated for instructor and pupil, and the setting is infinitely variable down to a maximum angle of 40 deg. On the Provost, flap control was of the three-position type.

Immediately forward of the flaps are fitted the air brakes (below the wing) and the spoilers (above), both sets of surfaces folding flush into recesses immediately behind the subsidiary spar, to which they are attached. Operation is, like that of the flaps, effected by double-acting pneumatic rams, which are connected to large-diameter torque tubes which, in turn, move the surfaces *via* cranks. The inner ends of the torque tubes carry pulleys which are connected by a cable circuit across the aircraft to maintain port/starboard synchronization. The geometry of the air-brake/spoiler assembly is clarified by the large drawing, which particularly underlines the high aspect ratio of the spoilers. These are of quadrant section, attached by piano hinges along their leading edges. The air brakes are stiffened by a massive top-hat section which, in effect, turns each surface into a spanwise box.

The air brakes and spoilers, being mechanically linked, cannot be used independently. Their primary purpose is to assist manœuvre and formation flying, in which functions they will be of great assistance; without such readily controlled drag the Jet Provost would be rather clean for easy station-keeping. Control is effected by a thumb button on the end of each engine power lever, response being precise and immediate.

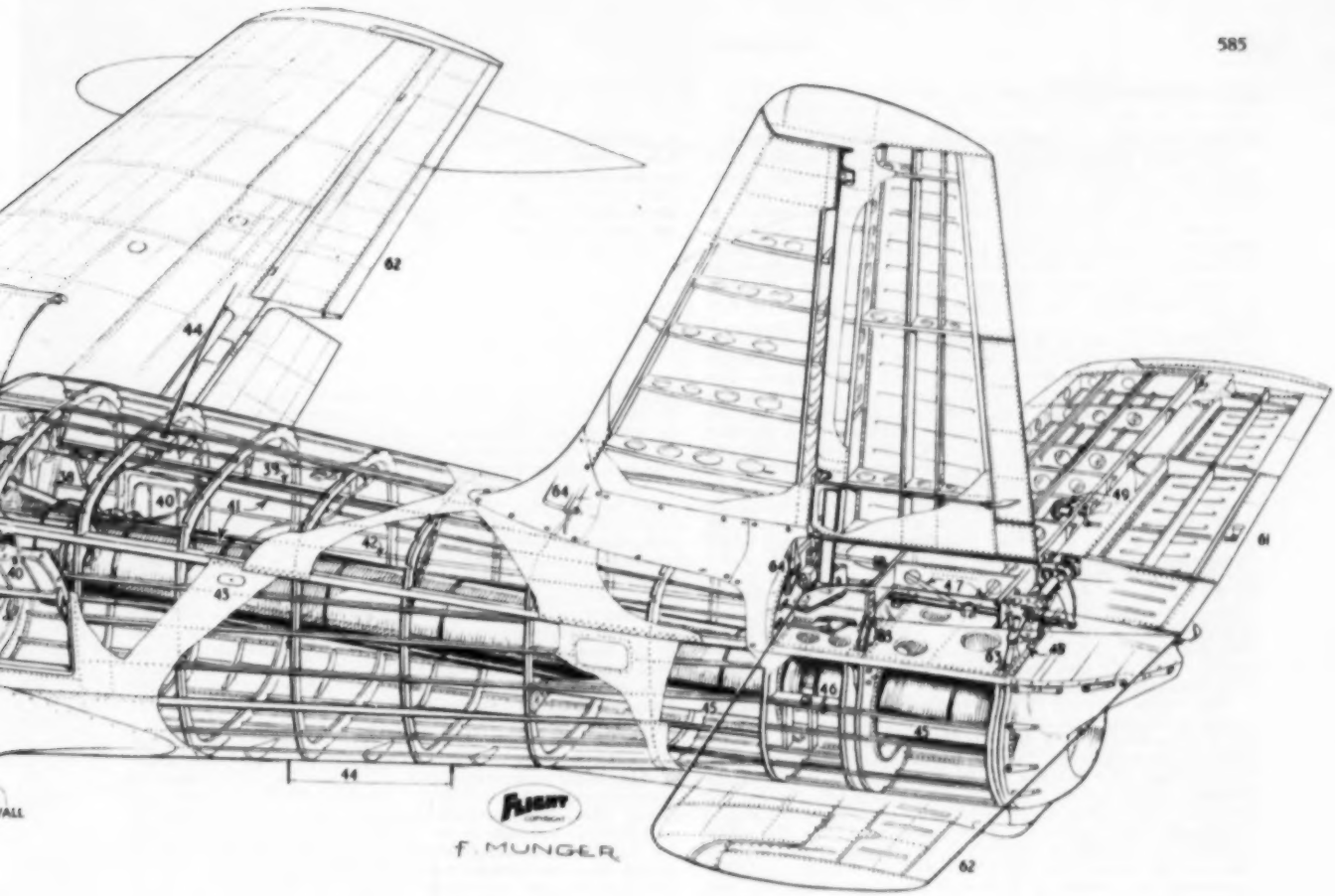
The Jet Provost cockpit is essentially the same as that of the Provost, with side-by-side seats, dual controls and standardized duplicated flying instruments including a Machmeter. The layout is apparent from the photograph opposite. The canopy slides in rails at the sides of the cockpit, and can be wound open or closed by a hand-crank, sprocket and chain system on the port side. To open the canopy from outside, the hand-wheel clutch can be disengaged by operating a toggle-lever on the port side of the fuselage (on the first machine a push-button was used for this

JET PROVOST . . .



KEY TO DRAWING

1 V.H.F. T/R radio, 19B7 (access through hinged nose).
2 T.B.A. receiver (T.B.A. marker radio, batteries and electrical equipment below).
3 Air bottles, 3,300 lb/sq in, main and emergency.
4 Oxygen cylinder.
5 Oxygen charging point.
6 Cockpit cool air to individual louvres on instrument panel.
7 Amber screen runner.
8 Rudder pedals with toe brakes.
9 Pupil's control console (power, trim, flap, undercarriage).
10 Access to under-floor control runs and electrics.
11 Canopy jettison.
12 Instructor's control console (power, trim, flap, undercarriage, high- and low-pressure cocks, relight switch, engine starting, air brakes, V.H.F. and T.B.A.).
13 Canopy winding unit.
14 External battery socket.
15 First-aid stowage.
16 Oxygen economizers.
17 T.B.A. control box.
18 Boundary air bleed, discharging under wing root.
19 Venturi.
20 Taxi lamp.
21 Air compressor (in cooling duct).
22 Pneumatics relief valve and regulator.
23 Engine power control run.
24 Generator.
25 Starter (vacuum pump behind).
26 Fuel flow-meter transmitter.
27 Fuel booster pump in inboard tank.
28 Low-pressure fuel filter.
29 Air bleed pipes from engine compressor casing to cabin air (heat exchanger and fuel tanks).
30 Relight control box.
31 Cool air duct (accessories, then combustion chamber compartment in aft fuselage).
32 Main engine mounting and engine rear steady.
33 Firewall (upper portion removable for engine changes).
34 Fire extinguisher spray ring.
35 Fire access panel.
36 Engine compartment ventilating air exit.
37 Aft fuselage ventilating air inlet.
38 Tailpipe sling (picks up on eye inside tailpipe to engine joint muff).
39 Tailpipe sling rail.
40 Access to tailpipe and control runs.
41 Rudder control (top). Elevator control (bottom). Only the port-side runs are indicated.
42 Control lock cables.
43 Static vent.
44 T.B.A. whip and marker aerials.
45 Tailpipe runner.
46 Tailpipe after-end support rollers.
47 Elevator trim cables.
48 Elevator lock.
49 Elevator trim jack.
50 Flap ram.
51 Spoiler and air brake ram.
52 Spoiler and air brake torque tube.
53 Undercarriage ram.
54 Fuel tank communicating flapper valves.
55 Fuel contents transmitters.
56 Compressed air to tip tank and fuel feed pipes.
57 Tip tank mounting point.
58 Pressure head fitting.
59 Aileron control.
60 Aileron trim jack.
61 Trim tab.
62 Balance tab.
63 Tailplane attachment.
64 Fin attachment.
65 Mainplane subsidiary spar pick-up.
66 Mainplane main spar attachment.



purpose). In emergency the sliding canopy can be jettisoned, complete with rails, by pulling a handle mounted centrally above the instrument panel. Originally, spring-loaded assisters were incorporated, but the canopy has been found to leave the aircraft cleanly under all conditions, solely as a result of the air loads.

Both seats are adjustable in height, although they are not of the ejection type. The high-flying ability of the Jet Provost has necessitated the provision of an oxygen system, this being fed from a single 2,250-litre bottle mounted in the nose. The cockpit is not pressurized, but hot compressor-bleed air can be admitted for heating purposes, diluted with air from a ram intake under the nose. Individual punkah louvres are provided for both pilots, supplied from ram intakes on each side of the nose decking. Undiluted compressor-bleed air can be supplied to perforated strips arranged along the lower faces of the windscreen panels for de-misting purposes. This hot-air supply is supplemented by a de-icing fluid spray system for the port and starboard (but not centre) screen panels, which are also provided with Dunlop hydraulic wipers. In present Jet Provosts there is no airframe de-icing.

Operational equipment installed in the new trainer roughly parallels that carried by its piston-engined predecessor. There is a similar form of amber-screen installation for simulated instrument practice, and—at customer request—the Jet Provost can be armed with a pair of nose-mounted 0.303in guns and an underwing load similar to that carried by the Armed Provost. So equipped, the aircraft would probably be used rather for police duties than for weapons training, although it should do the latter job as adequately as can any other machine of the same weight category.

The engine of the Jet Provost T.1 is at present the Armstrong Siddeley Viper 101 turbojet, which is supplied as the Viper 10101 engine-change unit. All the loads between the engine and airframe are taken by two trunnions, one on each side of the engine immediately forward of the annular combustion chamber. Each trunnion rests in a bearing on top of a pyramid structure of manganese-steel tubes, the trunnion bearings being so shaped that, when the engine is clamped in position, it is forced forward with the intake rim pressed hard up against the rubber O-seal around the outlet from the airframe intake duct. The port trunnion also permits slight lateral expansion movement. A third attachment point, under the rear of the engine, is employed as an aid

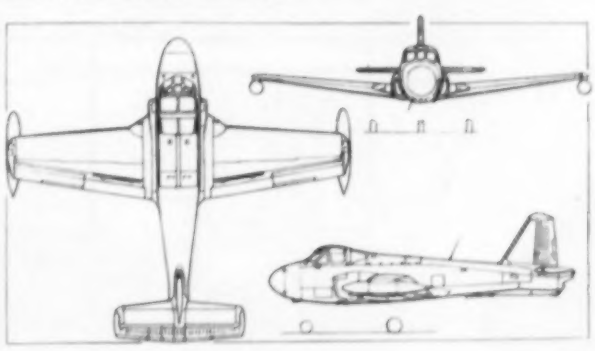
HUNTING PERCIVAL JET PROVOST T.1
(1,750 lb-thrust Armstrong Siddeley Viper 101)

Dimensions: Span, 35ft 5in (not including tip tanks); length, 31ft 11in; height, 12ft 8in; tailplane span, 13ft 6in; track, 10ft 1¼in; wheelbase, 9ft 9¼in; wing area, 213.7 sq ft (gross) or 181.3 sq ft (net); aerofoil section, N.A.C.A. 23015 mod. (root) to N.A.C.A. 4412 mod. (tip); aileron area, with tab, 12.1 sq ft each; tailplane area, including elevators, 48.8 sq ft gross; elevator and tabs, 20.8 sq ft; fin and rudder, 35.3 sq ft; rudder and tab, 11.54 sq ft; flaps, 9.11 sq ft each.

Performance: Based on data applicable to the first machine, and making the following assumptions: full internal fuel (171 Imp. gal) followed by, in brackets, data for maximum fuel load of 271 Imp. gal, the respective all-up weights being 5,950 lb and 6,750 lb. Fuel, aviation kerosine.

Maximum level speeds, 263 (261) kt at s.l.; 272 (268) kt at 10,000ft; 281 (277) kt at 20,000ft; and 276 (267) kt at 30,000ft. Rate of climb at 13,400 r.p.m., 2,520 (2,130) ft/min at s.l.; 1,930 (1,600) ft/min at 10,000ft; 1,375 (1,055) ft/min at 20,000ft; and 720 (440) ft/min at 30,000ft. Time to height from sea-level, 4.5 (5.5) min to 10,000ft; 11.9 (15) min to 20,000ft; 24.4 (35) min to 30,000ft. Ceiling, 31,000 (27,500) ft at 13,100 r.p.m. for 400ft/min climb. Stalling speed, 66 (71) kt, undercarriage and flaps down. Take-off in still air, I.S.A.: ground run, 410 (550) yd; total distance to 50ft, 665 (820) yd. Landing, same conditions: total distance from 50ft, 670 (740) yd; ground run, 380 (450) yd.

Ranges: typical values, assuming tip tanks on throughout, and making normal allowances and following a conventional flight-plan: at sea-level, 149 n.m. at 100 kt (245 n.m. with tip tanks full); 185 (312) n.m. at 160 kt; 158 (270) n.m. at 234 kt (max. cont.); at 10,000ft, 233 (397) n.m. at 186 kt, 209 (356) n.m. at 240 kt (max. cont.); at 20,000ft, 288 (495) n.m. at 192 kt, 263 (460) n.m. at 250 kt (max. cont.); at 30,000ft, 317 (563) n.m. at 197 kt.



JET PROVOST . . .

to alignment and as a steady (as shown in the sketch alongside).

The whole engine compartment is lined with stainless-steel sheet, and equipment includes 14 Graviner self-setting flame switches, connected in parallel and suitably disposed over the whole rear part of the engine-bay interior. Methyl bromide is contained in two bottles, which can be fired either by the inertia switches or (upon triggering, by flame-switches, of the panel warning light) by a cockpit push-button. The engine-compartment is drained through a drain-collector tank under the floor. Pressure in the compartment does not rise sensibly above ambient at any time.

Engine air is taken in through direct ram intakes on either side of the forward fuselage, and the subsequent ducts curve sharply inwards to meet at the circular-section entry to the engine. The boundary layer over the Jet Provost nose can, in some conditions, grow relatively thick, and wide bleed ducts are inserted between the main intakes and the fuselage skin, through which stagnant air is dumped overboard under the belly of the aircraft. Although they appear rather abrupt in their curvature, the intakes of the Jet Provost have proved completely satisfactory.

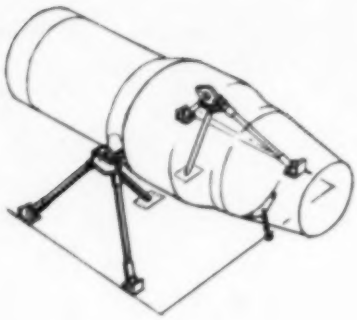
The jet pipe is 15ft long, and the length is accentuated by the small diameter. The pipe is inserted into the orifice at the tail of the fuselage and its forward end pinned to a carriage which hangs from two pairs of rollers running along the roof gantry previously described. The front end of the jet pipe is locked to the engine rear flange by a clamping ring, access to which is obtained through fuselage hatches which, in the Provost, were provided for the radio compartment. Once the pipe is secured, fore and aft, the carriage can be disconnected and clipped to the gantry. The pipe, and the engine exhaust connection, are lagged with heat-insulating blankets.

The engine is started by a Rotax electric starter (an air-nozzle starter is employed on some other Vipers). Engine controls are quite conventional. On the port side of the engine bay is the Rotol accessory gearbox. Driven by the engine through a short splined shaft, this gearbox carries the following units: at the forward end is the air compressor, a Dunlop Mk 1 delivering at up to 3,300 lb/sq in and fed from a tapping on the engine compressor; next behind is the D.C. generator (Type 505) which is cooled by air from an individual ram intake; and at the rear end are the starter and the Pesco B3X vacuum pump. The accessories are cooled by a flow of air tapped from the port boundary-layer passage, and the engine bay receives additional air from a duct flush with the underside of each wing-root fairing.

A total of 171 Imperial gallons of kerosine is normally accommodated in the internal tankage, which is entirely within the wings. Each main-plane houses two tanks forward of the main spar and one aft, all being bag-type products of Fireproof Tanks, Ltd. In addition, a non-jettisonable 50-gal Bristol reinforced-plastic tank can, at customer-request, be mounted externally under each wing tip.

All tanks are pressurized to rather over 1½ lb/sq in by compressor-bleed air. This air is ducted first to the tip tanks, if such are fitted, through Saunders and Hymatic valves, final delivery to the engine being effected by booster pumps in the inner wing tanks. All the wing tanks are interconnected, the fillers being in the outboard tanks behind the main spar. A 2-gal S.P.E. recuperator is inserted into the fuel system, this capacity being sufficient for 36 seconds' inverted flight at the maximum cruising r.p.m. of 12,700. A Rotol flow proportioner is another component, which, like most of the fuel equipment, is mounted under the port side of the centre-fuselage floor. Smiths-Waymouth contents gauges are fitted, as is a Kent flowmeter.

Hydraulics in the Jet Provost do not amount to more than a simple closed circuit driving the windscreen wipers, and already



A particularly simple form of engine mounting has been achieved, there being two main attachments carried by the steel tubes, and one rear steady.

mentioned. All the chief power requirements are provided by the pneumatic system, which is initially energized at 3,300 lb/sq in by the Dunlop compressor. The supercharging line between the Viper and the compressor is now provided only with a filter and pre-cooler, although a 35 lb/sq in reducing valve was fitted to XD 674. Main and emergency bottles store air at the full 3,300 lb/sq in, although this pressure is reduced to 750 lb/sq in before use. Air at the latter pressure serves undercarriage retraction, flaps and air brakes, and the wheel brakes are served by air which leaves a further reducing valve at 220 lb/sq in, finally reduced by the toe pedals to 180. The full 220 lb/sq in pressure is applied to the parking-brake circuit.

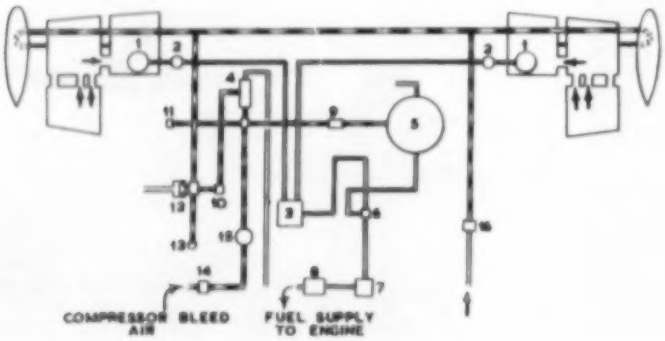
Negative pressure for the vacuum system, required by the blind-flying instruments, is, naturally enough, normally provided by the vacuum pump; in emergency, a venturi, mounted on the lower port side of the forward fuselage, is automatically brought into use. A single-pole 24-volt electrical system is used, the generator charging a pair of parallel-connected Varley 25 amp-hr batteries mounted in the extreme nose.

Normal radio equipment is the same as that for the Provost, although, of course, it has all been relocated in the nose, where it is accessible under the hinged nose-cap. The two standardized installations are A.R.I. 18062, a 10-channel V.H.F. system, and A.R.I. 5386, tunable beam approach. Intercom. facilities are provided *via* a section of the V.H.F. equipment, and the T.B.A. and V.H.F. outputs can, if desired, be mixed in the intercom. circuit. Aerials are conventional: the V.H.F. whip projects from near the centre of the port under-wing roundel, and the T.B.A. is served by a whip on the rear fuselage top decking and a wire underneath.

So much for the aircraft as it now exists. There remains the question of what constitutes the best military training sequence, and to what extent the Jet Provost is likely to find a market.

The Jet Provost is intended, first and foremost, as an *ab initio* military trainer. It is, therefore, visualized as a replacement for, and not an addition to, the numerous piston-engined primary or basic trainers at present in service. Every air force in the world is already partially jet-equipped or looking towards the time when it will be. Certainly, all the more important flying Services use predominantly jet-powered operational types, and it has long been generally agreed that it is profoundly illogical to train a pilot to fly piston-engined aircraft and then make him convert to jets —probably with the aid of a powerful and advanced ex-fighter-type machine costing well over £100 per hour to operate. The very act of training with piston-engined machines inculcates a pupil with hardly learned and deep-seated techniques which, to a great extent, he has to unlearn again later on. Only the small proportion of pilots who go to transport, or possibly ocean-patrol, units require piston-engine knowledge and mentality.

It is also relevant to the question to note the results obtained by the U.S.A.F. At the end of—or during—the primary stage of flying training in the U.S.A.F., a high percentage of pupils have been rejected for reasons other than ability to fly; thus a cheap



The Jet Provost fuel system is outlined here in diagrammatic form. Internal fuel is carried in bag-type tanks in the wings; the tip tanks are Bristol plastic units. The system is described on this page.

KEY TO DRAWING

1 Booster pump.
2 Servicing cock.
3 Fuel flow proportioner.
4 Hot-air reducing valve.
5 Recuperator.
6 Low-pressure fuel cock.
7 Flow-meter.
8 Low-pressure filter.
9 Air reducing valve.
10 Non-return valve.
11 High-pressure test point.
12 Air relief valve.
13 Low-pressure test point.
14 Non-return valve.
15 Filter.
16 Non-return valve.

first-stage aircraft—such as the Jet Provost—remains essential. Again, we have seen numerous reports, from several air forces, which underline the number of jet accidents which can be ascribed, partially or wholly, to the pilots having retained piston-engined techniques in his flying.

As is well known, the R.A.F. have taken a fairly bold step in establishing a two-prong training sequence, using the Provost and the Vampire T.11. That this sequence works superbly there can be no doubt, for courses are now passing out, and a large number of individual case-histories are to hand. The Provost, quite an advanced machine, is used *ab initio*, and to a total of some 120 hr (per pupil), during which time nearly all the pupils who will not make the grade are weeded out. Those who complete the Provost stage then do about 110 hr on the Vampire, and during this time the wastage rate is very low indeed. After a further few hours at an O.C.U. the pilot can pass straight to a fighter squadron, and thus make a sonic bang 235 hr from his first flight. (Bearing in mind what Mach 1 meant 10 years ago, this is noteworthy.)

If the Jet Provost were used in place of the piston-engined machine it is calculated that at least 30 hr could be cut from the Vampire syllabus and, in effect, added to the Jet Provost time. Thus the flying-training course might begin with 150 hr on the Jet Provost, during which time the pilot would be amassing jet experience, using oxygen, flying high, and getting used to aircraft which have no torque or slipstream, as such, and which burn up fuel rapidly at low level. Training would then be rounded off by about 80 hr on the Vampire. This sequence would probably cost no more, and possibly much less, than that now employed. Although the Jet Provost costs considerably more to run—particularly on "circuits"—than does the corresponding piston-engined machine, the saving in Vampire time is most important. In any case, even if pilot-training were suddenly to double or treble in cost it would be of far less (relative) importance than in the past. In World War 2, many millions of hours were flown to produce hundreds of thousands of pilots, and cost per hour was a major factor. Today, air forces employ far fewer aircraft (we have been told, for example, that Bomber Command may establish its medium bomber force at a total of some 100 machines) of extremely great individual cost. As a result, the expenditure needed to train a pilot is immaterial; what is essential is that he shall be the finest possible pilot when he eventually assumes control of one of the few, precious, operational aircraft.

Other air forces have adopted aircraft which seem to be wedded to the three-prong system. For example, France has the Magister and America the Cessna T-37, both of which are, in our opinion, just a trifle "slippery" for *ab initio* work. On the other hand they are "not enough aircraft" for use as advanced trainers. It seems logical to use a machine like the Jet Provost for the primary stage, and to continue the pupil on it to quite an advanced stage in his training. Mach effects, weapons training and the like can then be assimilated, easily enough, by changing to a machine like the Vampire. As for the so-called advanced trainer, it seems obvious that this will—in the foreseeable future, at least—be the discarded fighter.

At any rate, it was in 1951 that the Air Ministry, pleased with its Provost—then about to enter service—decided that it would be a good thing to have a jet development of the same basic design for evaluation. The Hunting Percival P.84, then a private venture project, was activated and actual conversion design began. As we have said, the aim was to produce a basic jet trainer as cheaply and as quickly as possible, so that it could be in Service hands for evaluation at the earliest possible date. Thus, as much of the Provost was retained as possible. But this was by no means the compromise that it might be thought; the Provost had already shown itself an excellent aircraft at the low-speed end of the scale, and the company's engineers took care not to lose the viceless spin and stall characteristics of the piston-engined machine. Very little interest was shown in ultimate V_{max} and Mach number.

It was in March 1953 that an order for a service-test quantity of Jet Provosts was placed. The first machine, XD 674, flew for the first time at Luton on June 26th of last year, in the hands of R. G. ("Dick") Wheldon. So trouble-free was the aircraft that seven flights were made during the following three days. This first machine has now flown approximately 180 hr, and has also been extensively tested by the R.A.F. and M.o.S. Four Jet Provosts are now flying, and the remainder of the batch now on order are coming through the shops.

There is at present no large-scale order for the Jet Provost, but this would seem to be only a matter of time. The company have stated that, when built in large numbers, the design will be slightly cleaned up in detail. The Hunting Percival designers, with an eye to the future, have also projected developments of the basic machine, which should prove very attractive. In any event, the basic design seems to be suitable for eventual development for use in a number of Air Force, Navy, and possibly even civilian, rôles.

CANBERRAS FOR ECUADOR'S AIR FORCE

IN the striking photograph below, a Canberra B.6, serial No. 802, thunders off from its makers' runway at Warton, Lancashire; it is bound for Gander, on the first leg of a delivery flight to the Ecuadorian Air Force base at Salinas. In company with another B.6, as the first instalment of an order, the aircraft crossed the Atlantic in 4 hr 30 min for the 2,224 miles, representing a speed of 494 m.p.h.

In the group are seen the two delivery crews, with English Electric officials. Left to right: R. Hothersall and P. D. W. Hackforth of English Electric; R. Moneypenny, of Silver City Airways (who have quite a reputation for providing expert delivery crews); Maj. R. Sandoval, Ecuadorian Air Force; Capt. J. W. Hackett, Silver City; Maj. G. Barreiro, E.A.F.; and M. Cole, Silver City.

These two aircraft will not be the first Canberras to join a South American fighting Service; four B.2s were delivered to the Venezuelan Air Force over a year ago. It is noteworthy that such a recent bomber type as the Canberra B.6 is available for export.

THE FIRST ROUND

Swansea Sees the Start of the 1955 National Air Races

"FLIGHT" Photographs

THOUGH the names of most competing aircraft and pilots were familiar enough, last Saturday's racing at Fairwood Common, Swansea, differed in one important respect from previous meetings in the post-war series of National Air Races. It introduced a new system whereby competition for six of the classic trophies will be spread over the entire season. Final awards will be made on the basis of points scored at each or any of four major meetings in 1955.

At the final meeting—to be held at Coventry on August 20th—the 15 highest-scoring pilots will be eligible to compete for the King's Cup, so that this senior event will form a climax to the racing season. The British Air Racing Championship will also be decided on a points basis, though a pilot taking part in more than one round at a single meeting will be credited only with the points won in his best round.

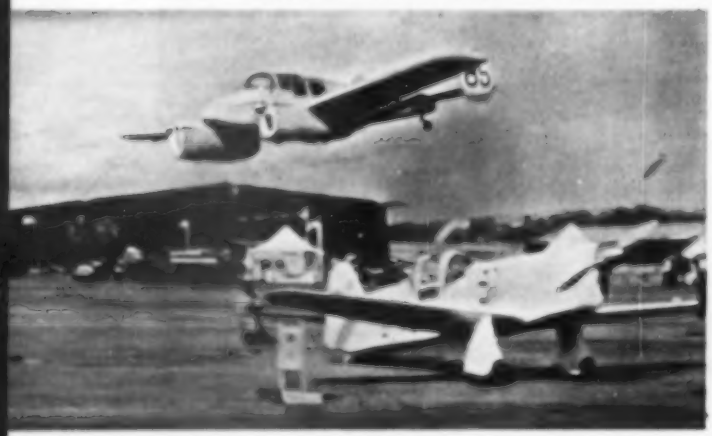
The Fairwood programme began with the arrival, in a departmental Dove, of Mr. John Profumo, Parliamentary Secretary to the Ministry of Transport and Civil Aviation. He was greeted by the Mayor of Swansea, Ald. T. S. Harris, who joined Mr. Profumo and other members of the official party for a tour of the

Pre-race scene: Dunkerley's Mew Gull, with pilot Peter Clifford at extreme right, and one of the Newcastle Tigers. In the foreground is the polished nose of Ron Paine's Hawk Speed Six.

8½-mile quadrilateral circuit—this time in a Dove of Cambrian Air Services. The aircraft was subsequently much in demand for joy-rides, at ten shillings a head, around the Swansea area.

Arriving shortly before the Dove, *Flight's* Gemini was the first occupant of the park for visiting aircraft. By 2 p.m., when the programme was officially declared open, it had been joined by nearly 30 other visiting machines, and a large crowd was packing into the enclosures bordering the runway and parking area. Weather remained cheerfully bright throughout the day, though

(Below) Coming in low at the finish of their respective races are Nat Somers (Gipsy-Gemini) and Beverley Snook (Tiger Moth).



Though outclassed, Crewdson pressed on gamely in his Agusta-Bell 47G, first helicopter to take part in a British air race.

Not a public execution, 1955-style, but a rescue demonstration by the Westland S-51 from the R.N.A.S. Brawdy. Downwash from the rotors created quite a stir among the spectators at Fairwood Common.

the capricious south-westerly breeze may have upset some of the handicappers' finer calculations.

There were five laps to each race, giving a course distance of 42½ miles. The layout of the course provided the public with a view of competitors at nearly all stages of the racing; unfortunately, very little overtaking occurred, and there were no last-minute surprises.

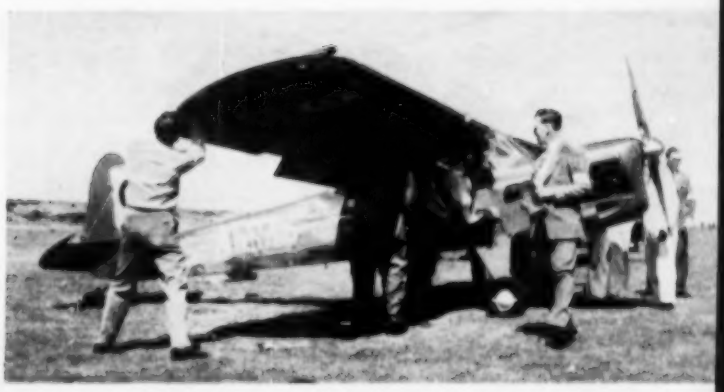
Particularly tame was the opening event, the first round of the Air League Cup—a Proctors-only race which had attracted but two entrants. T. G. Knox, flying his glossy black Proctor 3 G-ALCK, not only maintained but increased his 7 sec starting advantage over E. Noel Husbands (Proctor 1 G-AIHG).

Starting and finishing order were also identical in round one of the S.B.A.C. Challenge Cup race, for aircraft capable of at least 160 m.p.h. in level flight. Geoffrey Marler (Falcon Six) scored a first victory in this event, which was the poorer for the absence of the Sparrowjet, third member of the Dunkerley stable. Flown by Peter Clifford, Dunkerley's Mew Gull was again unable to beat its handicap, taking third place behind Ron Paine's familiar Hawk Speed Six.

Entry to the Norton-Griffiths race is this year confined to Tiger Moths. Five examples were at Fairwood for the first round —a colourful assembly, comprising two silver-and-green specimens (G-ANSH and G-ANSX) from Fair Oaks, pale blue (G-AMTK) and dark blue (G-AMLF) Tigers from Newcastle, and the privately owned black-and-red machine (G-ANOD) flown by the Hon. Peter Vanneck. It seemed that we were not alone in detecting few differences between the various Tigers, for the handicappers allowed the first aircraft only nine seconds' start on the back marker. This was hard on G-ANOD, for it carried pilot and passenger, whereas its four rivals were flown solo and outpaced it by up to 10 m.p.h. J. H. Denyer, in G-AIVW, set up a commanding lead early in the race and held it throughout.

In his bronze-coloured, well-finished Gemini 1A (G-ALZG), P. Blamire won the first round of the Goodyear race (for Geminis only) quite comfortably from throttle-benders Fred Dunkerley and Nat Somers. The extra 6 m.p.h. conferred by the Gipsy Majors in G-AKDC, the Somers aircraft, was not quite enough for it to catch up with Dunkerley's Cirrus-powered G-AKKB.

The next event, round one for the Grosvenor Cup (for aircraft, other than Tiger Moths, capable of up to 130 m.p.h.), produced a newcomer to the air-racing scene—the Agusta-built Bell 47G (G-ANZK) entered and flown by John Crewdson of Rotorfilms, Ltd. It was soon apparent that the helicopter, *per se*, enjoys no particular advantage as a racing vehicle other than the ability to fly from its dispersal to the starting line, and a higher initial rate of acceleration when flagged away. Averaging a little over 80 m.p.h., it was soon overtaken by Miss Freydis Leaf's 95-m.p.h. Tipsy Trainer, G-AFWT. Second and third places were taken by C. Gregory (Taylorcraft G-AHGZ) and D. Westoby (Aiglet G-AMMS). This latter, a well-polished red machine, once the demonstration model used by Ranald Porteous, had been entered



Last-minute polish for the Aiglet entered by comedian Jimmy Edwards.

by one J. K. O'N. Edwards, D.F.C., better known as comedian Jimmy Edwards; of the genial "Professor" himself, we saw no sign. Clearly visible in the goldfish-bowl canopy of their Agusta-Bell, Mr. and Mrs. Crewdson took their disappointment in good part and were still conversing amiably as they rotored home in fourth place.

Round 1 of the Kemsley Race (for aircraft capable of exceeding 130 m.p.h.) was the day's second event for Nat Somers, who moved his Chipmunk G-AKDN up from fourth place to win at 137 m.p.h. Scratch-man J. Spiller (Messenger G-AKIN) dropped to second place, and David Ogilvy's Comper Swift *Black Magic* (G-ABUS), fell back to third. Flying a hooded Hawk Trainer (G-AJRT) in his first race, "Johnny" Johnston finished fourth, followed in by Wheatley's attractive white-painted Globe Swift.

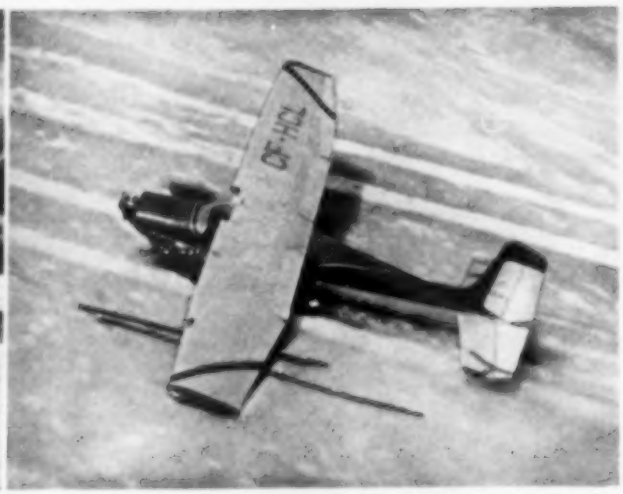
All told, a satisfactory if not spectacular start to the season's racing. Perhaps subsequent meetings will bring more aircraft of greater variety; perhaps the handicappers, too, will have recaptured fully the prophetic power which has resulted in so many exciting finishes at past races.

The brief but effective Service demonstrations at Fairwood Common amply compensated for any shortage of excitement in the racing programme. The star performance was by an R.A.F. Hunter from Chivenor, which arrived in a near-sonic "whoosh" and kept the crowd on its toes throughout the next ten minutes. A Brawdy-based Naval Dragonfly demonstrated both the "scoop" rescue net and the more conventional sling, and the Vampires of 614 (County of Glamorgan) Squadron, R.Aux.A.F., showed pace and precision in their air-drill.

The meeting concluded with the presentation of trophies by Mr. S. Kenneth Davies, chairman of the Royal Aero Club. In addition to the prizes listed below, J. N. Somers, as highest-scoring pilot, was awarded the Welsh Air Derby Trophy.

1955 NATIONAL AIR RACES: FIRST-ROUND RESULTS

Aircraft	Pilot	Place	H'cap m. s.	Speed m.p.h.	Points		
					H'cap	speed	Total
Air League Cup							
Proctor 3	T. G. Knox	1	00 00	133.5	14	2	16
Proctor 1	E. N. Husbands	2	00 07	129	12	1	13
S.B.A.C. Cup							
Falcon Six	G. Marler	1	00 00	159.5	14	0	14
Hawk Sp. Six	R. R. Paine	2	01 42	177.5	12	1	13
Mew Gull	P. Clifford	3	03 17	197.8	10	2	12
Norton-Griffiths Trophy							
Tiger Moth	J. H. Denyer	1	00 00	103.5	14	4	18
Tiger Moth	B. Maile	2	00 09	103.5	12	4	16
Tiger Moth	B. J. Snook	3	00 07	101.5	10	2	12
Tiger Moth	J. M. Donald	4	00 07	100	8	1	9
Tiger Moth	P. Vanneck	5	00 00	94	6	–	6
Goodyear Trophy							
Gemini 1A	P. Blamire	1	00 00	139	14	–	14
Gemini 1A	F. Dunkerley	2	02 54	161	12	1	13
Gemini 2	J. N. Somers	3	03 29	167	10	2	12
Grosvenor Cup							
Tipsy Tr. 1	Miss F. Leaf	1	01 46	95	14	1	15
T'craft Plus D	C. Gregory	2	06 20	110.5	12	2	14
Aiglet J5K	J. Westoby	3	08 33	120	10	1	11
Bell 47G	J. Crewdson	4	00 00	81.5	8	0	8
Kemsley Trophy							
Chipmunk	J. N. Somers	1	01 27	137	14	4	18
Messenger 2A	A. Spiller	2	00 00	126	12	–	12
Comper Swift	D. F. Ogilvy	3	00 43	128	10	1	11
Hawk Tr. 3	I. Johnston	4	01 23	132	8	2	10
Globe Swift	C. G. Wheatley	5	01 43	132.5	6	3	9



OFF THE ICE

Or, Saved from a Watery Grave

ALMOST daily come examples of noteworthy rescue or salvage operations in which the helicopter has played the star part. The latest news story—of the salvage variety—is told in these pictures, just released by the R.C.A.F. A Cessna 180 of Boreal Airways sank through the ice after landing on a frozen lake in dense bush country 300 miles north of Montreal. A thaw threatened its complete loss. Asked to help, No. 108 Communications Flight, Bagotville, decided that one of their Piasecki H-21s would be the vehicle for the job. After a call at St. Felicien, Boreal Airways' base, where the Flight's C.O., S/L. R. T. Heaslip, planned the operation with company officials, the H-21 took fuel and salvage equipment to a small landing-strip 18 miles from the lake. S/L. Heaslip and his co-pilot, F/O. D. McNeill, then continued to the lakeside, but found it impossible to put the big helicopter down on the marshy ground until four crew-members had been winched down to prepare a spruce-tree bed. Next, after some tricky work, often waist-deep in icy water, the crew secured a sling round the Cessna. With a hook suspended below the H-21, Heaslip then took off; but the minute-by-minute story of the rescue is told in the pictures, starting above. It only remains to be added that the Cessna was successfully carried "in formation" over the 18 miles to the landing strip.

Above, then reading downwards: The victim in its ice-hole and the rescuer on its spruce bed; the crew having rigged a sling round the Cessna, the H-21 hovers for the hook-up; connection established, the big helicopter climbs away and the Cessna is pulled out like a cork from a bottle (note the spray of water and ice-fragments); the strange "formation" leaves for the landing strip; and there the Cessna is seen, showing a bent airscrew blade tip as its only injury.

IGOR SIKORSKY IN GREAT BRITAIN

Pioneer Helicopter Designer's Lecture to the Institution of Mechanical Engineers

ONE of the heaviest lists of engagements ever to face a visiting aeronautical engineer to this country was fulfilled during the last week of April by the distinguished helicopter designer, Igor I. Sikorsky, who is engineering manager of the Sikorsky Aircraft Division of United Aircraft. After his arrival on April 22nd he visited Westland Aircraft, Ltd., at Yeovil and on the 26th made radio and television broadcasts on the subject of helicopter achievements and potentialities. On the 27th, a dinner in his honour was given by the Royal Aero Club and the following day he attended a reception at Londonderry House to meet members of the Helicopter Association.

At this function he gave an informal talk covering helicopter developments up to the present time and outlining his ideas on the future. He quoted the production of S-55 helicopters up to the present time as being 866, adding that his company hoped to reach the 1,000 mark by the end of the year. Development of the twin-engined S-56, he said, was proceeding rapidly, some 250 flights having been made. This machine had been shown to be capable of maintaining height on one engine, and at maximum a.u.w., at up to 5,000ft. After the reception, in company with council members of the Association, Mr. Sikorsky was entertained by the directors of Westland Aircraft, Ltd.

On April 29th—last Friday—he presented his paper, entitled *The Transport Helicopter*, as the James Clayton lecture to the Institution of Mechanical Engineers; this was the main reason for his visit to England. After the lecture, Mr. Sikorsky was entertained to dinner by the Institution's president, Mr. P. L. Jones, M.C.,B.Sc., Wh.Ex. On the following day he repeated the lecture at Bristol University. Wherever he went Mr. Sikorsky was enthusiastically received, and he was presented with the James Watt Memorial Medal—awarded to him some months ago—by the Institution of Mechanical Engineers. The award was in recognition of his outstanding contributions to the development of multi-engined aircraft, long-range flying-boats, and helicopters.

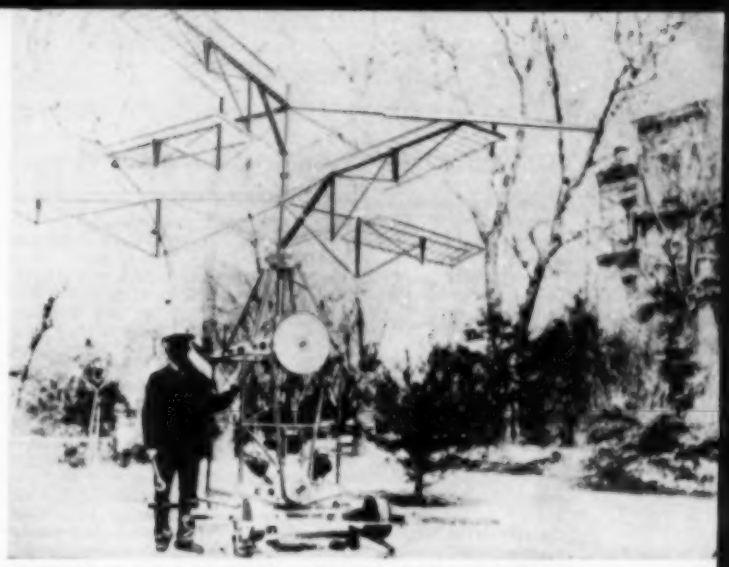
He began his lecture to the Institution by giving a brief outline of the history of rotating-wing aircraft, giving credit to, among others, Caley, Bréguet, Cierva and Focke. He also mentioned his own work in building a helicopter with a 25 h.p. engine in 1910. This was, he said, a very good helicopter from which he gained much experience—"it had only one drawback—it wouldn't fly."

Korea had rightly been called "the proving ground of the helicopter." There, rotating-wing aircraft had performed outstanding feats of rescue in addition to communications and other duties. A total of over 22,000 casualties had been evacuated by helicopter during this conflict.

An interesting type of helicopter, the appearance of which in the near future might confidently be expected, was the special freight-cargo machine specifically designed to lift any type or shape of load and to carry it suspended below the fuselage. In this respect, the helicopter had advantages over all other forms of transport. The shape of a prefabricated piece of equipment, for example, might preclude its carriage in any other way.

A study was at present being conducted to determine the best configuration for such a machine and the best location for the pilot's cabin. A novel arrangement had been suggested in which the cockpit would be suspended below a narrow tubular fuselage, substantially behind the centre of gravity. Such an arrangement would involve some restriction of view forwards and upwards but had undoubted advantages in that the pilot would have an excellent view of the object to be carried; it would allow an object such as a transportable house to be lowered directly on to its foundation. An excellent beginning of such methods had already been made with existing helicopters and, within the next decade or so, this type of aerial crane would be instrumental in promoting a whole series of new enterprises and industries which would depend on making direct deliveries of objects in a ready-to-use form.

Mr. Sikorsky continued his lecture with his views on the probable direction of future development. In the case of the pure helicopter—a machine in which all lift and forward components of thrust were derived exclusively from the action of the one or several lifting rotors—there were reasons to maintain that operating speeds would never be much in excess of 200 m.p.h. Boundary-layer control, to delay stalling of the retreating blade, showed promise of providing a means of achieving higher speeds, although the increase would not be great.



An historic picture of Mr. Sikorsky with his No. 2 helicopter in 1910.

A somewhat higher speed could be obtained by the use of the compound helicopter, which employed small auxiliary wings, and airscrews or jets, to carry a part of the load and provide the forward propulsion. With this type the speed range might be increased by 50-75 m.p.h. over that of the pure helicopter. A more radical type, the convertible helicopter, could take off vertically as a helicopter and then become converted into an aeroplane to travel at considerable speeds, probably several hundred miles an hour. However, although many projects in this category could be (and had, in fact, been) built, he believed that as a general rule such machines would be considerably more expensive and less efficient than either the pure helicopter or the pure aeroplane of equal lifting capacity. For this reason they would probably have only a limited utilization, mainly for certain specific military operations. The V.T.O. aircraft was an extension of this last-mentioned category.

The pure helicopter would find its greatest utility in short-haul operations and for lifting the heaviest loads, while the compound helicopter might have greater advantages for somewhat longer ranges and in passenger carrying where speed was of greater importance. There was room for both types in the sphere of commercial operations.

As far as power problems were concerned, the use of engines and a mechanical transmission to the rotor shaft or directly to the rotor hub seemed the most practical for helicopters of up to 100 tons' all-up weight. While other methods could be visualized, the metal gear transmission was used in the majority of practical helicopters. It was possible that hydraulic or pneumatic transmissions would make their appearance when their efficiency had been improved; at present no transmission of such types could ever approach the 96-97 per cent efficiency currently reached in well-designed metal gear transmissions of modern helicopters. Piston engines or turbines combined with mechanical transmissions would, therefore, be used in the majority of helicopters for an indefinitely long period.

In certain cases, particularly for still larger machines, it might be advantageous to eliminate the transmission and apply the force directly at the tips of the blades in the form of jets. The configuration might possibly be similar to that which had been analysed and described by Mr. O. L. L. Fitzwilliams, of Westland Aircraft, and which utilized complete turbojet units mounted at the blade tips. While the construction of such aircraft would involve the serious engineering problem of producing a turbojet capable of withstanding considerable centrifugal and gyroscopic forces, it would also raise the problem of carrying heavy loads on the tips of the blades. In a super-giant aircraft of this kind, the blade supported by a landing gear of its own, which could be retracted when the blade becomes airborne, might be foreseen. Other suggested methods would involve the use of supporting members which would be folded or removed when the blade became airborne or when the centrifugal force became sufficient to support the blade. In spite of the serious and novel problems which would be encountered, an aircraft of this type would certainly be possible. Such arrangement might become particularly interesting in a helicopter of a gross weight much in excess of 100 tons.

With respect to other characteristics, Mr. Sikorsky believed that future helicopters, particularly the large ones, would have heavier disc-loadings and lighter power-loadings. Study and experience indicated the advantages of a single-rotor configuration for all sizes, and especially for the giant helicopter, yet with large rotors

IGOR SIKORSKY IN GREAT BRITAIN...

it might be advantageous to use a greater number of blades of a moderate chord. There were reasons to believe that this would increase the smoothness and decrease the control loads of the aircraft.

It was very probable that aircraft engines would continue to be the principal powerplants of helicopters, as at present. But increased use of the turbine could be expected, because rotating-wing aircraft would profit even more from its characteristics than would the aeroplane. It was probable that, for the multiple-engined turbine-driven helicopter, engines with the free turbine wheel would be preferable because, in the event of one engine becoming inoperative, it would be possible to obtain nearly the full power of the remaining turbines at a somewhat reduced number of revolutions of the rotor.

In the medium-size and large-size helicopter, it might be advantageous in the future to use a combined system of application of power. Basic power would consist of engines or turbines geared to the main rotor shaft or, in larger units, preferably directly to the huge rotor hub of the aircraft. A secondary power system would consist of a turbine or turbines driving compressors, to send compressed air through the blades for jet power at the tips, with or without superheating.

In the proposed arrangement it would be possible to utilize passages within blades of normal cross-section which, as a rule, were smaller than would be desirable if pure pressure-jet drive were used; yet, for a partial-jet drive, it would permit efficient utilization of the existing cross-section without the need of increasing the thickness of the blade beyond that indicated by aerodynamic and structural considerations. Furthermore, it would permit use of the light but inefficient system for take-off, or for any time when a burst of power would be needed, while for ordinary cruising it would be possible to operate under the more efficient engine and transmission system. Also, this would allow for having a somewhat smaller torque-compensating device.

Finally, the compressed-air system of this type could be utilized for anti-icing by preheating the air to an adequate temperature before it was channelled into the blade passages.

In very big machines, of more than 100 tons gross weight, it might be advantageous to apply all or most of the power directly at the outer ends of the blades in the form of either pressure jets or complete turbojets. A considerable number of other arrangements that would permit transmitting or generating the power at the tip of the blade had already been proposed. Particularly for giant helicopters, it would seem very desirable to eliminate the torque, together with the great stresses in the centre of the craft and the torque compensating device, by applying the entire power directly to the tips of the blades. So far, however, no arrangement of this nature had been tested that would approach the efficiency and general operating characteristics of a helicopter with a transmission and a torque-compensating control rotor. It was, therefore, not impossible that the conventional formula would survive even on giant helicopters. In certain designs of this nature it might be advantageous to use hydraulic, pneumatic, or electric transmission of power to the tail rotor. It might even be necessary in some cases to eliminate the transmission by using a separate powerplant—perhaps two governor-controlled turbines—to generate the power for the tail rotor.

Mr. Sikorsky (right) receives the James Watt Medal from Mr. P. L. Jones, president of the Institution of Mechanical Engineers.

Concerning the configuration of the aircraft, the lecturer thought that the giant and super-giant helicopter of the future would still be a single-rotor aircraft, obviously with a large rotor with a great number of blades and a very heavy disc loading.

Mr. Sikorsky concluded by reviewing briefly the possibility of using nuclear power as a source of power for helicopters. There was no doubt that such power could be used, he thought, as soon as a suitable powerplant became available. One of the logical arrangements that could be foreseen, he continued, was as follows: "A turbine of generally conventional type in which the air, after being compressed, becomes overheated in a heat-exchanger into which, in turn, heat is supplied from a nuclear reactor by circulating melted metal, or by some other means. The major problem in this case would still be to protect and insulate the occupants from the powerful radiation that would be created by the nuclear reactor. It is probable that on a sufficiently large machine, a reactor could be situated far in the very bow of a fuselage of the aircraft and be properly insulated, while the crew could be located far behind, in the rear end of the craft. This, or similar solutions, however, might involve certain difficulties."

The greatest obstacle, which would probably prevent the use of atomic energy in helicopters for some time to come, was the fact that there might not be sufficient advantages in doing so. While very fast, nuclear-powered, possibly supersonic, aircraft with virtually unlimited flying range would be tremendously valuable, yet practically all the missions of the helicopter were for short range.

Before concluding his lecture Mr. Sikorsky showed an excellent film depicting the development of his helicopters from the first attempts in 1910 to his latest achievement, the twin-engined S-56. The film also included sequences showing commercial helicopter operations in Northern Canada.

R.Ae.C. COMMITTEES, 1955-56

THE Royal Aero Club announces the constitution of its various committees for 1955-1956, as set out below; also given are names of stewards, timekeepers and other competition officials, together with those of the F.A.I. representatives.

THE COMMITTEE

President.—Lord Brabazon of Tara.

Vice-Presidents.—Capt. Sir Geoffrey de Havilland, Lord Gorell, Viscount Kemsley of Dropmore, Sir Francis K. McClean, Sir Frederick Handley Page, Whitney W. Straight, The Duke of Sutherland.

Chairman.—S. Kenneth Davies.

Vice-Chairman.—Air Chief Marshal Sir John Boothman.

Committee Members.—Capt. K. J. G. Bartlett, Air Marshal Sir Roderick Carr, J. G. Crammond, Lt-Col. C. F. H. Gough, E. S. Greenwood, R. G. Kent, Capt. A. G. Lamplugh, Maj. R. H. Mayo, H. W. H. Moore, G/C. C. S. Morice, Maj. H. A. Petre, Maj. J. Steward, Lawrence Swan, J. C. C. Taylor, C. F. Uwins, F. Woodhead.

Other Committees

Finance.—Capt. K. J. G. Bartlett, J. G. Crammond, E. S. Greenwood, Maj. R. H. Mayo, G/C. C. S. Morice, Maj. J. Steward, C. F. Uwins, F. Woodhead.

House.—J. G. Crammond, G/C. C. S. Morice, Maj. J. Stewart, J. C. C. Taylor, Capt. H. S. Broad, E. H. W. Lucas, Capt. J. G. Renton, S/L. C. K. Turner-Hughes, Capt. R. H. Walmsley, G. H. Wilkinson.

Records, Racing and Competitions.—E. S. Greenwood, Capt. A. G. Lamplugh, Maj. R. H. Mayo, Capt. H. S. Broad, E. C. Bowyer, J. Cunningham, W. P. I. Fillingham, I. A. Forbes, Cdr. A. Goodfellow, D. J. Lyons, P. B. Mayne, R. R. Paine, J. K. Quill, F. Rowarth, J. N. Somers.

Private Flying and Air Touring.—R. G. Kent, Maj. H. A. Petre, J. C. C. Taylor, J. G. Benson, C. E. Berens, W. H. Byars, J. R. Cory, E. S. Davies, A. D. Duncan, J. J. Dykes, J. C. Elwes, R. E. Hardingham, J. M. Houlder, D. Constable Maxwell, P. Q. Reiss, H. M. Samuelson, J. N. Somers, A. G. Wilson.

"Royal Aero Club Gazette."—R. G. Kent, Geoffrey Dorman, A. D. Duncan, E. H. W. Lucas.

Londonderry House Maintenance.—G/C. C. S. Morice, G/C. J. F. H. du Boulay, Miss N. Collins.

N.B.—The chairman of the Club, Mr. S. Kenneth Davies, is an *ex-officio* member of all committees.

Stewards of the Club

Lord Brabazon of Tara, Air Marshal Sir Roderick Carr, Lord Gorell, Sir Francis K. McClean, H. W. H. Moore, Maj. H. A. Petre, The Duke of Sutherland, F. Woodhead.

Officials for Records, Races and Competitions

Timekeepers.—P. B. Mayne (chief timekeeper), Maj. J. W. Barber, Maj. A. L. Ebblewhite, A. J. Gibbons, Maj. Gen. A. H. Loughborough, L. H. Lumby.

Handicappers.—F. Rowarth (consultant), D. J. Lyons (chief handicapper), C. M. Britland, W. J. Charnley, Miss I. J. Ferguson, W. S. Johnson, D. R. Murrin, L. R. Wilson.

F.A.I. Representatives

Capt. K. J. G. Bartlett (president), Maj. R. H. Mayo (vice-president and sporting), P. A. Wills (gliding), Col. R. L. Preston (touring), Maj. T. W. Willans (parachuting), A. F. Houlberg (models), Sir Harold E. Whittingham (medical).

Other Representatives

British Gliding Association.—M. O. Imray.

Association of British Aero Clubs and Centres.—C. F. Uwins.

Society of Model Aeronautical Engineers.—M. O. Imray.

The Popular Flying Association.—J. C. C. Taylor.

FABRICATIONS to FLOAT and FLY

Rubber Dinghies, Balloons, and Much Else: The Work of the R.F.D. Company

"FLIGHT" photographs

Mr. A. van Beugen Bik, the managing director.

IT is seldom difficult mentally to associate an aeroplane, or even an engine, with the factory of its birth; little effort is needed to form a mind-picture of major structural components in their jigs, or the whir and rattle of portable power tools, or the characteristic oily smell of an engine assembly shop.

But there are certain kinds of aviation equipment, perfectly familiar kinds, that somehow defy any such association of ideas. One of them, to the writer at least, has been the life-saving dinghy. The rubber dinghy was just one of those things one took for granted; it was something made by specialists. Their methods were a sealed book; for all one knew, rubber dinghies might almost be grown on plantations in Malaya, daily swelling fatter and yellower on their trees until ripe for plucking.

Thus it was with an open mind that we recently visited the works of the R.F.D. Co., Ltd., who, as all the aviation world knows, are large-scale manufacturers of inflatable life-saving craft of all conceivable sizes and shapes, from the fighter pilot's single-seat light-weight raft to a twenty-man dinghy (it is, in fact, their claim that they are the only firm with British Government design-approval for the manufacture of A.S.R. rubber dinghies). We knew, too, that they make a great deal else besides—kite balloons, for instance, and aerial gunnery targets—but the extent of their full list of products was a surprise. It reads something like this:—

Lifejackets (three types, Naval, Air Force and civil aviation); Air Force single-seat life-rafts; aircraft rubber dinghies (ten different types, with from two to 20 seats); aircraft "Universal" life-rafts (six-, ten-, and 20-seat); Naval life-rafts; rowboats, outboard-powered assault craft and fire-floats (all three pneumatic); aircraft sea-rescue dropping gear; target gliders (two types, standard and radar-responsive); banner targets (two varieties, air-to-air and A.A.); drogue targets in three sizes; ciné-film target simulators, infantry and tank; "Portobel" dome gunnery trainer (ground or sea to air); Naval "rocking deck" gunnery trainers; battle-noise simulators; paratroop training balloons and winches; pneumatic lifting-bags for jacking aircraft on soft ground (four-ton and 12-ton); containers for dropping fuel or water to survivors at sea; flameproof and acid-proof clothing in various types for Service and industrial uses; and aircraft protective covers.

To all this must be added the fact that R.F.D. are prepared to make almost anything in these fields to special order and also that they either manufacture or supply the multitude of small but vital oddments that furnish life-saving craft—oddments that read like the catalogue of a shop that stocks groceries, cutlery, drugs, yachtsmen's sundries and pyrotechnics in equal diversity.

The letters "R.F.D." are the initials of the late R. F. Dagnall, an expert in lighter-than-air craft during the First World War. He had also made a study of flotation gear of various sorts, and in 1918 he constructed some of the earliest rubber dinghies. After the war, in a small works at Stoke Road, Guildford, he began the manufacture of equipment of this kind together with gliders: in 1930 he improved on the German Zögling primary glider and marketed it under the name of Dagling. In July 1934 his firm was made into a limited company under its present title, and in 1936 a new factory was built in pleasant semi-rural surroundings near Godalming. In 1942 Mr. Dagnall died, in his late fifties.

Expansion has since been continuous. There is a 60,000 sq ft factory at Belfast, at present given over mainly to life-raft production for the Admiralty, Merchant Navy and Royal Canadian Navy; and there are subsidiary companies in Canada, Australia, South Africa, France and Holland; a Swedish company is to begin operations shortly. Apart from the advantages of being closely in touch with local requirements, these overseas units perform a valuable research function; thus the Canadian company is in a position to subject equipment to Arctic tests, and the South African factory can conduct tropical trials.

The present Board of the R.F.D. Co., Ltd. consists of Mr. N. J. Hulbert, D.L., M.P. (chairman), Sir Norman Nixon and Mr. A. van Beugen Bik (managing director); and senior executives include Messrs. K. A. Golding (secretary), C. H. Latimer-Needham, M.Sc.(Eng.), F.R.Ae.S., M.S.A.E., R. V. Edwards (technical development), D. K. Hailstone (sales manager) and J. Aitchison (general manager, textile).

Last year there was a disastrous fire at the Godalming works, and, though full production was soon restored by a process of compression and re-arrangement in undamaged departments and temporary buildings, the completion of rebuilding is eagerly awaited, as it will facilitate the flow of work.

And what a flow it is! Dinghies, lifejackets and balloons alone call for some 2,500 different components and detail items; and there can be few industries that utilize a greater variety of materials; rubber in almost every imaginable form; a score of different kinds of fabric; wire, cordage, wood, plastics, brass, copper, steel; all these, and many more, are fashioned by the tools and machines of skilled workers.

The uninitiated visitor is equally impressed by the contrasts he finds in the nature of the work as between one shop and the next. First, perhaps, he is shown the balloon-loft, a hangar-like upper

(Upper picture) A paratroop training balloon begins to take shape. (Lower) Sewing the special fabric from which banner targets are made.

(Left) One end of the life-raft and dinghy assembly shop, with some of the larger types of dinghy in various stages of completion; colour would be needed to do justice to this picture, for some of the rafts are the familiar yellow and the others, black below, have a new "flame orange canopy." (Right) The sections of fabric from which rafts are made are cut from a pattern traced on the top layer of a number of sheets.

FABRICATIONS TO FLOAT AND FLY . . .

storey with a floor as smooth as that of a ballroom. Down the centre lies a miniature mountain-range of silvery fabric, with overalled girls kneeling among its valleys—a 45,000 cu ft paratroop training balloon, 83ft long, 33ft in diameter, and capable of lifting five men and a despatcher. One end of the envelope is inflated—with air, of course—and startling bulgings and movements bear witness that work is going on inside as well as out. The girls in the interior are working by artificial light, for proofed and aluminised balloon fabric is wholly opaque. (This fact provides one of the means of inspection: with the interior light extinguished, the smallest pinhole can be detected.) The fabric, incidentally, is a high-grade cotton woven to a strict M.o.S. specification and used in vulcanized two-ply form, with the two layers "biased"; this technique confers great strength. The work on which most of the girls are engaged is the uniting of the fabric panels (of which there are about 600) by means of tape and adhesive solution, and the attachment of patches to which the rigging bridles are secured.

In complete contrast to this lighter-than-air work is that conducted in a nearby shop, where half-inch steel plate and I-section girders are being cut, welded, drilled and bolted. Ultimately they take shape as mountings for Naval gunnery trainers—platforms which, carrying either aiming recorders or actual guns, are caused by an electric motor and cam mechanism to roll, pitch and yaw as unpredictably as a destroyer in a North Sea gale.

Gunnery training equipment, both of the simulator variety and in the form of actual targets, has long been an R.F.D. speciality. Farnborough Show visitors may recall seeing the "Portobel" trainer, a 30ft-diameter dome which, inflated by a small blower, encloses the whole of the training equipment. This latter consists primarily of (a) a dummy gun on a mounting, or two director control units; and (b) a 35 mm ciné projector which throws a moving picture of the target (e.g., a low-flying aircraft approaching head-on) on the interior of the dome. By electronic means, "hits" resulting from correct aiming, deflection and firing are automatically recorded. For ground-to-air training, appropriate noises of a loud and intimidating nature are added by means of sound-effects equipment. The electronics side of these particular R.F.D. products adds yet another facet to the variety of the work.

Full-size air-tow targets of various kinds—not forgetting gliders which can be towed at high subsonic speeds—are less simple to manufacture than might be supposed. A 30ft by 6ft banner target, for example, must be capable of absorbing numerous cannon-shell strikes without shredding and disintegrating. At Godalming such targets begin life in a vast roll of fabric known as "Leno"—a kind of coarsely woven nylon. Before it is cut into individual banners the material is subjected to a complicated process of treatment which begins by stretching on a big machine specially designed for the purpose, and then goes through various stages of dipping and proofing. When the banner is complete, with its metal spreader and balance bar, and spray-painted with target markings, it is of a texture very different from the raw material: a shell will go through it and leave a relatively "clean" hole, without causing—to use a silk-stocking analogy—ladders or runs.

But in studying these various training aids we have, perhaps, stayed too long outside the department whence come the products for which, after all, R.F.D. are chiefly famed—namely, life-saving dinghies and other inflatable craft.

The multitude of differently shaped pieces of rubberized fabric from which dinghies are made are cut from sheets which may be as long as 100ft, and 40in wide. A number of sheets—ten, in the material-thickness used for single-seat dinghies—are laid on top of one another on a long table, and the shape of the sections marked on the top sheet with the aid of templates (in the case of the single-seater raft's buoyancy assembly there are 16 differently shaped sections, and outlines for sets of 16 are repeated over and over again along one length of fabric). Using a portable electric tool like a miniature circular saw, an operative then cuts swiftly but accurately along the lines.

The sections are assembled in a separate shop, mainly by girls working at long tables. Assembly is largely a process of seaming the various parts by means of tape and adhesive solution, a process in which clean surfaces are very necessary if satisfactory results are to be obtained; close inspection is carried out at all stages.

When the main inflatable components have taken shape, they are air-filled to facilitate further assembly. As will be seen in one of our photographs, the larger rafts carry a canopy supported on a framework of pneumatic tubes which are self-erecting when the raft inflates itself in the water. Typical equipment which is added in the assembly shop includes stabilizing water pockets, handlines, boarding ladder, CO_2 valve, and rubbing strips.

As will have been noticed from the list given in the early part of this article, not all R.F.D. craft are of life-saving varieties. There is, for instance, the "Z" type of inflatable craft originally developed by the company's French associates—and, incidentally, used by Dr. Bombard on his famous single-handed Atlantic crossing under sail. Primarily intended for military purposes, such as commando assault, these boats are capable of over 30kt on the power of a 650 c.c. outboard motor. Another type of craft is the "Bikini" fire-float—the name is a play on that of the company's managing director—which utilizes water-jet propulsion from one of its three lightweight fire pumps; these have a total output of 1,000 gal/min. Thanks to its lightness, this craft can easily be dragged over mud-flats to the water's edge, and it could be used—with or without fire pumps—as an emergency tender for airfields bordering on areas of water.

Adjoining the dinghy shop is another, mainly equipped with electric sewing machines, in which a great variety of work is carried out. Here we noticed, among many other items, supply-dropping parachutes, banner targets into which radar mesh was being sewn, and various components for the R.F.D. dropping gear, which is a development of the well known Lindholme gear. This equipment consists of five cylindrical containers connected to one another by buoyant rope, the largest container enclosing a ten-seat Universal life-raft which inflates automatically on reaching the water, and the smaller containers being filled with supplies; the rescue gear is released from an aircraft so that it falls across the path of drift of survivors already in the water.

An interesting point observable in a number of these shops is the method of distinguishing various fabrics; the "interior" side of each material bears a different pattern, according to whether it is to retain air or gas, and a concise code-group gives very complete information as to the weight, strength, texture and other characteristics of the material. It is by such means as this that much of the production-control is performed; until he becomes aware of these unobtrusive methods, the visitor to R.F.D. may get the impression that the emergence of the finished article from large quantities of widely varied raw materials is, perhaps, a matter of luck and guesswork. But control is very much there, as the quantity and quality of the company's products over a long period of years has amply demonstrated.

R. E. C.

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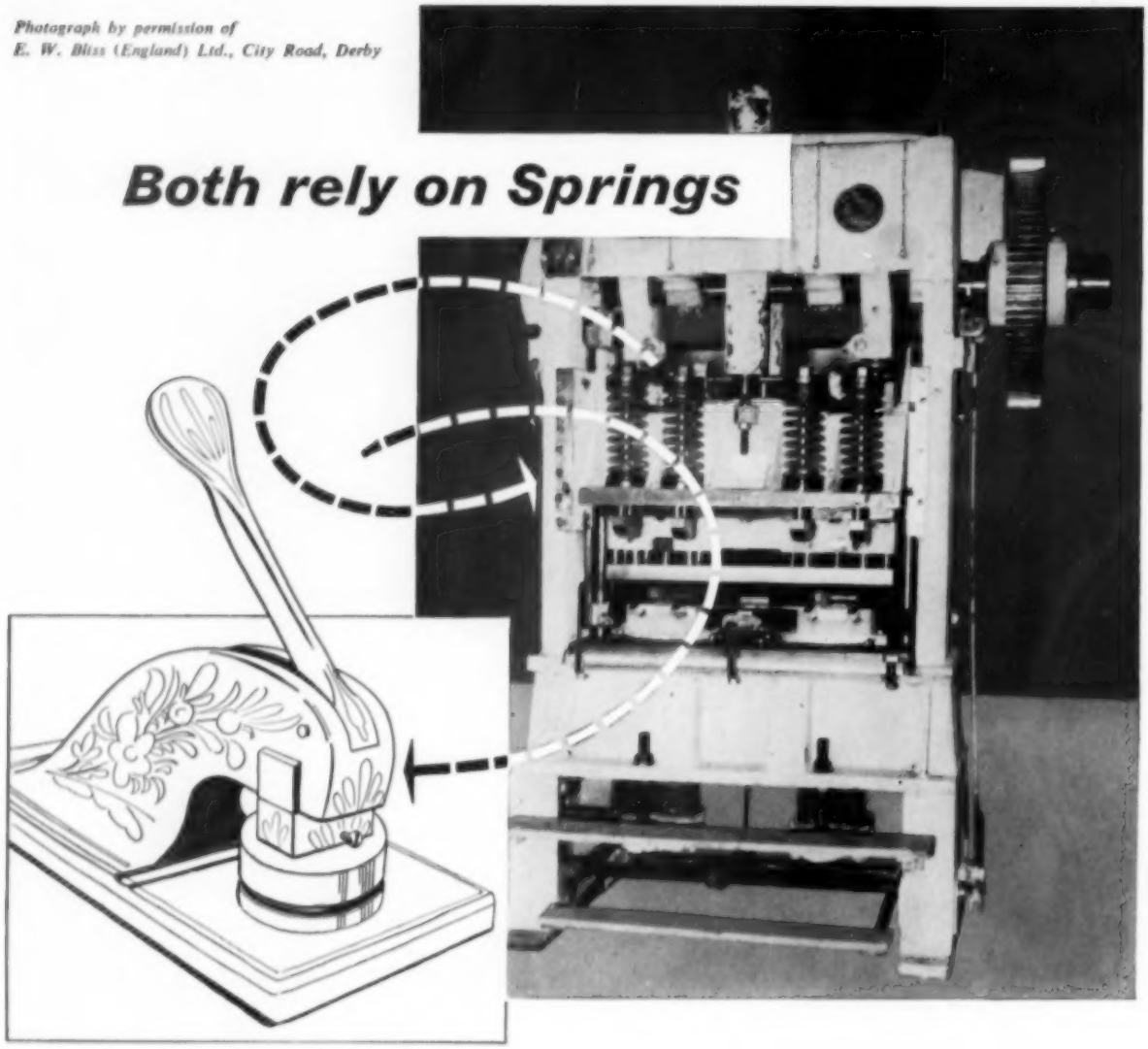

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CIVIL AVIATION

Three de Havilland Canada D.H.C.3 Otters were delivered recently to Philippine Air Lines for local services. P.A.L. are one of four airlines now operating scheduled flights with these large (14-seat) single-engined transports; the others are Canadian Pacific, Avanca and Wideroes og Polarfly (Norway).

T.A.A. ORDER MORE VISCOUNTS

AN order for three more Viscounts is announced by Trans-Australia Airlines, now operating a fleet of five with conspicuous success on their trunk-line routes. To be delivered in mid-1956, the new aircraft will bring T.A.A.'s Viscount strength to nine (another machine having been ordered recently to replace that lost in a training accident last year). They will be of Viscount 700D type, with 1,600 s.h.p. Dart 510 turboprops and slipper tanks for increased range; the T.A.A. version of this type will be designated Viscount 756.

The new order is valued at about £900,000. It brings the number of Viscounts sold to 186, of which 52 are in service. Including T.A.A., six Viscount customers have now announced increases in their initial orders.

Two of the present T.A.A. Viscount fleet—VH-TVE and 'F—already have the new slipper tanks, which were fitted to give guaranteed regularity on the 1,419-mile Perth-Adelaide route under all headwind conditions. Viscount services between Melbourne and Adelaide *via* Perth began on April 20th, and results to date have been completely satisfactory.

A SECOND LUFTHANSA

THE East German Government news agency announced last week the formation of a civil airline named Deutche Lufthansa, which is to operate from Schönefeld Airport, on the outskrts of Berlin. An agreement on the use of the airport was stated to have been signed between Mr. Georgi Pushkn, the Soviet High Commissioner, and the East German Minister of the Interior, Herr Willi Stoph. No details of the aircraft fleet to be flown by the Eastern German Lufthansa were given.

BRITANNIA SERVICES NEXT YEAR

SPEAKING at London Airport on his return from a tour of Africa, Sir Miles Thomas said on Sunday that B.O.A.C. hoped to have six Britannias in service by the summer of 1956. They would go into service first on the route between London and Johannesburg. The Comet 4, to be introduced in 1958, would bring Cairo within 5 hr flying time of London, Nairobi within 10 hr and Johannesburg within 17 hr.

AIRWORK'S HELICOPTER INTERESTS

TWO British independent operators of widely varying interests have jointly formed a company to develop commercial utilization of helicopters. The companies are Airwork, Ltd., and Fisons Pest Control, Ltd., who have become co-partners in the firm of Fison Airwork, Ltd. The new company will take over the eight Hiller 360s now operated by Fisons Pest Control, and its future plans include every type of helicopter operation additional to the agricultural and forestry work now undertaken.

Airwork will be responsible for developing new business, including charter, survey and construction; Fisons will continue to be responsible for obtaining agricultural contracts and for designing the equipment required on this work. The board of Fison Airwork, Ltd., will consist of Mr. M. D. N. Wyatt, Mr. W. J. McEwan, Mr. J. J. E. Harper, Dr. W. E. Ripper and Maj-Gen. G. E. Wildman-Lushington. Initially, at least, the headquarters of the company will remain at Bourn, near Cambridge, where the Hillers are now based, but it may later move to one of Airwork's centres of operations.

NEW APPROVALS

THE operation of the following air services has been approved by the Minister of Transport and Civil Aviation, after considering the recommendations of the Air Transport Advisory Council:—

Airlines (Jersey), Ltd.: Normal scheduled service, Jersey-Bilbao, until August 30th, 1961.

British European Airways: Normal scheduled services; London-Dusseldorf and/or Munich-Athens-Istanbul (optional), until March 23rd, 1961; London-Salzburg via Frankfurt (optional), until March 31st, 1962; London-Ajaccio-Malta, until September 30th, 1961; Manchester-Milan via London (optional), until May 31st, 1962. Helicopter services: London Airport (and other aerodromes in the London area)-central London terminal, until November 10th, 1964; Gatwick-London Airport, until December 2nd, 1961. All-freight service: London-Dusseldorf, until February 10th, 1962.

British Overseas Airways Corporation: Normal scheduled service, London-Frankfurt or Dusseldorf-Cairo or Nicosia or Beirut-Khartoum-Aden-Entebbe-Nairobi, until December 17th, 1961.

Eagle Aviation, Ltd.: Normal scheduled service, Blackbushe-Luxembourg-Innsbruck, until October 31st, 1961. Inclusive-tour service, Blackbushe-Bordeaux (technical stop)-Valencia, until October 31st, 1955.

East Anglian Flying Services, Ltd.: Normal scheduled service, Portsmouth-Shoreham-Le Touquet, until March 31st, 1961.

Hunting-Clan Air Transport, Ltd.: Colonial coach service, London-Biarritz (technical stop)-Gibraltar, until December 23rd, 1956.

Silver City Airways, Ltd.: Vehicle ferry service, Southampton and/or Lydd-Deauville, until December 31st, 1961; Belfast-Stranraer, until December 31st, 1961. Freight and vehicle ferry service, Blackbushe-Elmdon-Formby-Belfast, until December 31st, 1961.

U.K. TRAFFIC, 1954

OPERATORS in the United Kingdom carried 2,452,000 passengers on scheduled services during 1954, an increase of 14 per cent over the previous year. These passengers flew 1,517 million passenger-miles, an increase of six per cent, and freight traffic increased by five per cent to 36m ton-miles. Total traffic increased by four per cent—a smaller rise than in the previous year, due mainly to the grounding of the B.O.A.C. Comet fleet.

Detailed figures for the two Corporations and associated private companies for the calendar year 1954 are given below:—

	B.O.A.C.		B.E.A.		ASSOCIATES	
	1954	% change on 1953	1954	% change on 1953	1954	% change on 1953
Aircraft miles	30,376,000	− 8.2	23,065,000	− 4.1	6,206,000	+ 42.4
Passengers ...	282,633	− 2.3	1,829,221	+ 12.2	340,246	+ 42.7
Freight (short tons)	6,315	+ 2.4	18,307	+ 6.1	48,568	+ 23.2
Mail (short tons)	3,361	+ 0.7	6,938	+ 8.6	48	+ 84.6
Capacity ton/miles	206,298,000	− 3.0	94,582,000	+ 17.5	16,930,000	+ 45.8
Load ton/miles	132,762,000	− 3.2	60,951,000	+ 18.3	10,947,000	+ 40.8
Overall load factor	64.4	64.5*	64.4	64.0*	59.3	61.5*
Passenger miles	879,974,000	− 3.8	557,016,000	+ 20.2	79,953,000	+ 53.5

* 1953 actual load factors.

B.E.A. AIRCRAFT SHORTAGE

CURRENT fleet problems due to a shortage of aircraft were described recently by Mr. Peter Masefield, chief executive of B.E.A., writing in the Corporation's monthly house magazine. At the middle of April, he said, B.E.A. were eight aircraft short of the number planned. Three Viscount 701s remained to be delivered (all were now due by mid-June), four Viscounts were temporarily out of service following minor accidents, and one Elizabethan had been damaged beyond repair.

Of the four damaged Viscounts, G-ALWF (damaged on landing at Blackbushe last December) was expected to return to service by the end of May, and G-AMOL (damaged in a snow bank on landing at Copenhagen in March) by mid-June. Both G-AMOB (damaged on take-off at Blackbushe last December) and G-AMOK (damaged on take-off at London Airport in January) were due back in service in autumn this year. Elizabethan G-AMAB was damaged beyond repair in a forced landing in low visibility at Dusseldorf on April 8th.

"To relieve somewhat our aircraft shortages," Mr. Masefield continued, "we have just completed negotiations to hire from the Norwegian Fred Olsen company two Viscount V.736 aircraft due for delivery later this year. These aircraft, operating in B.E.A. service and colours for two years until the Viscount-Major V.802s are fully in service, will help quite a bit."

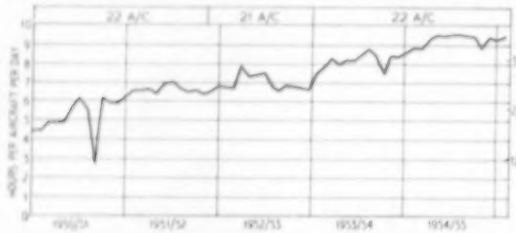
First L.1049G Super Constellations delivered to Europe are those of Lufthansa, who plan to begin their Hamburg to New York service in June. The flagship, illustrated here, displays wing-tip tanks and airscrew spinners—two features exclusive, as yet, to this version of the L.1049. As illustrated overleaf, future DC-7s will also have spinners.

CIVIL AVIATION . . .

THE HARD-WORKING ARGONAUT

A HYBRID airliner with the best qualities of a thoroughbred, the Canadair Four is undoubtedly still among the finest of the world's transports. Many operators must regret that production ceased long ago, and that its sole civil operators are B.O.A.C. and T.C.A.—both of whom have recently expressed the utmost satisfaction with a performance which, in the commercial sense, has improved rather than deteriorated with the years.

The excellence of the Argonaut, as it is styled by B.O.A.C., is not superficially apparent. Argonauts hold no speed records, have no unique attraction to offer the passenger, and are not strikingly handsome in appearance. None the less, the type has those vital qualities which are the very basis of air transport: it is outstandingly reliable, it flies well and it makes money.



Revenue utilization of the B.O.A.C. Argonaut fleet plotted over the past five (financial) years; the daily rate has increased by over 4 hr.

The Argonaut entered service with B.O.A.C. on August 23rd, 1949. Delivery of the fleet of 22 was completed on November 11th of that year—eight months ahead of schedule. In their first full year of operation (1950-51), Argonauts flew a total of 42,175 hr, each aircraft averaging 5.12 revenue hr daily. This rate of output has risen steadily ever since—from 6.58 hr daily in 1951/52, 6.95 hr in 1952/53, 8.13 hr in 1953/54 to 9.30 hr in the financial year ended March 31st, 1955. Total flying hours logged by the fleet last year were 75,820.

Credit for the performance of the Argonaut (and of its Canadian counterpart, the North Star) must be shared between several parties—notably the Douglas company, who provided the basic DC-4/6 airframe; Canadair, the constructors and originators of the type; and Rolls-Royce, who supplied the Merlin power-units.

S.A.S. DIRECT TO OSLO

ON April 19th, two days after the opening of London Airport Central, Scandinavian Airlines System inaugurated a direct service to Oslo with DC-6 OY-KLY. The London-Oslo flight was completed in 3 hr 12 min. Four S.A.S. services now operate from London direct to Oslo each week, in each case the aircraft continuing on to Stockholm. The distance from London to Stockholm by this route is 981 miles, and the new schedules call for this to be completed in 5 hr including a 20 minute stop on the ground at Fornebu. It was noted that passengers were not permitted to leave the aircraft during refuelling at Fornebu, nor at Kastrup on a return flight *via* Copenhagen.

SCOTTISH HERONS

GOOD load factors are reported on the B.E.A. feeder services now flown with Herons in place of Rapides. A passenger on the second commercial service to be operated by the new aircraft observes that full loads of passengers were taken on the Renfrew-Tiree and Tiree-Barra legs.

The residents of Castlebay have now become accustomed to seeing the Herons arrive, due to many proving flights and landings on the famous beach (Europe's richest cockle strand). Forward bookings show that the Herons are likely to step up passenger figures in this already air-minded part of Scotland.

TURBOPROPS OUTBACK

IT is expected that the first of two Viscounts ordered by Butler Air Transport will be delivered in August and introduced into service in October. It is believed that Butler will be the first company to use Viscounts solely on local, as opposed to intercity routes. The company's operations manager, Captain Young, will shortly begin a three-month familiarization course with B.E.A. before taking delivery of the first aircraft. The founder of the airline is Mr. Arthur Butler, managing director and chairman, who still flies on regular air services at least once a week as a first officer.

NEW TOWN TERMINAL FOR B.E.A.

DESIGN work has begun on a permanent city air terminal building to replace B.E.A.'s existing building at Waterloo Air Terminal. The Corporation has notified the London County Council that it will vacate the Waterloo site in 1957. Construction of the permanent terminal will not be completed for some years, and temporary accommodation will be provided during the interim period. The building will be erected on a steel-framed deck covering a triangle of railway tracks adjoining the Cromwell Road, West London.

B.O.A.C. ENGINEERING CHANGES

REVISED arrangements for maintenance of Stratocruisers and Constellations are announced by B.O.A.C. Formerly, engineering on both types was supervised by a single fleet maintenance engineer. In future, Stratocruiser maintenance will take place in the south and east hangars of the new B.O.A.C. headquarters at London Airport. In charge will be Mr. E. J. Curwood, who becomes fleet engineering manager, Stratocruisers.

Hangars 2, 3 and 4 will be given over to Constellation maintenance under Mr. R. A. V. Dismore with the new title of fleet engineering manager, Constellations.

Airwork Atlantic, who inaugurated DC-4 all-cargo services between London, Montreal and New York last March, have now introduced a weekly DC-6A service. The aircraft (one is illustrated here) are at present on hire, with crews, from Slick Airways, Airwork's own DC-6As being due for delivery in January. The DC-6A service, which phases-in with Slick's trans-continental flights, carries some 12 tons weekly in each direction; in addition, there is also a weekly DC-4 service.

The POWER of Armstrong Siddeley

For the first time pupil pilots of the Royal Air Force are to carry out ab initio training in a jet engined aircraft—the Percival Provost jet trainer. There can be no greater compliment to the reliability and performance of the Armstrong Siddeley Viper turbojet which is chosen to power the Provost. Meanwhile installed in the Folland Midge light fighter prototype the Viper is achieving supersonic speeds. It is perhaps the smallest engine in the world to do so.

ARMSTRONG SIDDELEY MOTORS LIMITED

PARKSIDE · COVENTRY

Members of the Hawker Siddeley Group

HOT TIP for the B.I.F.

Do you want a cert?
Do you want to come away
from Castle Bromwich richer
nor what you went in?
Then take my tip—
straight from the 'orse's mouth—

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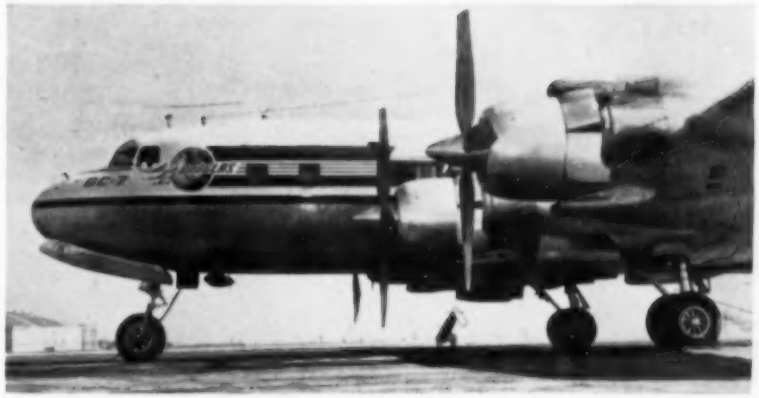
CIVIL AVIATION . . .

A SMOOTHER "SEVEN"

MORE efficient cooling of the Wright Turbo-Compound engines of the Douglas DC-7 is provided by spinners and crankcase fairings, as fitted to the prototype illustrated here. For a given cowl-flap setting, the engines will operate at some 30 deg F lower head temperatures ("a development," says Douglas, "especially beneficial for hot day conditions"). All DC-7Bs and DC-7Cs will be so equipped, and conversion kits will be offered to operators of existing "Sevens."



DC-7B prototype, which has been fitted with spinners (see news item above).

BREVITIES

AN all-freight service between Montreal and Vancouver was inaugurated by T.C.A. on May 2nd. The service, which runs five times weekly through Toronto, Winnipeg, Edmonton and Calgary, is operated by North Stars carrying up to nine short tons of cargo. Three of the T.C.A. North Star fleet have been converted for this work.

* * *

Two 55-seat Skyways Hermes have been chartered to transport the Philadelphia Philharmonic Orchestra around Europe during their forthcoming tour. Consisting of 110 people with three tons of instruments and baggage, the party will visit at least 10 European capitals.

* * *

The manager of B.O.A.C.'s first fleet of DC-7Cs, delivery of which is expected to begin in 1956, will be Captain M. J. R. Alderson who was manager of the Comet fleet from its inception. Previously, Captain Alderson was manager of B.O.A.C.'s operational development unit. A former line pilot of long experience, he joined Imperial Airways in 1933.

* * *

The new United Kingdom public relations manager for Trans World Airlines is Mr. Laurence Langley, formerly sales promotion manager for that airline.

* * *

The number of passengers handled at Kingsford-Smith Airport, Sydney, in 1954 totalled 985,000—ten per cent more than in the previous year. Freight and mail tonnages were 22,700 and 2,000 respectively, representing increases of some 24 per cent in each case.

* * *

The Civil Aeronautics Board has approved an application by T.W.A. for the extension to Zürich, of Trans-Atlantic services previously operated *via* London and Frankfurt.

* * *

The big Idlewild overhaul base of Lockheed Aircraft Service-International performed nearly twice as much work during the first quarter of 1955 as in the corresponding period of 1954. Conversions represented the major activity, followed by line maintenance, modification and reconditioning in that order. Turnover at L.A.S-I. during the quarter totalled 534 aircraft, including 471 four-engined commercial transports.

* * *

During the financial year ended March 31st, 1955, Aer Lingus operated 16,075 services compared with 17,046 in the previous year. Due, however, to the introduction of larger aircraft (Viscounts), the airline's passenger traffic increased by nearly 14 per cent—from 300,000 to nearly 343,000.

* * *

Shareholders of the Douglas Aircraft Co., were told on April 25th that the company's commercial backlog was worth nearly £120m, and that negotiations and discussions then in progress were expected to increase this amount by a further £35m. Since the beginning of this year Douglas have received orders from 19 airlines for a total of 142 aircraft in the DC-6/DC-7 series.

* * *

America's busiest airport during 1954 was Midway, Chicago, with a total of 349,363 aircraft movements. Arrivals and departures thus averaged nearly 1,000 daily. Other leading airports (movements in parentheses) were:—Miami (268,889); Honolulu, T.H. (266,583); La Guardia (236,012); Denver (235,362); Cleveland (223,741); Dallas (215,685); Atlanta (211,674); Louisville (Bowman) (210,507).

* * *

At an inquest on the victims of the T.A.A. Viscount training accident at Mangalore, Australia, last October, the operators were criticized by the coroner for allowing a pilot of only nine hours' type-experience to act as instructor and check-pilot on the Viscount. It was stated that the pilot concerned had made only three practice three-engined take-offs before the accident, which followed loss of control when the Viscount became airborne at less than the minimum safe speed for a three-engined take-off. The court also criticized fire-fighting equipment at Mangalore.

FROM THE CLUBS

WARM, sunny weather on April 24th so unsettled the local club inhabitants at Denham that 18 of the 34 tea-patrol visitors were allowed to arrive unobserved. Even those whose tea-money was *not* refunded, however, agreed that the meeting was a most successful one. Entertainment was provided by the Vintage Aeroplane Club's formation team (Eddie Hewitt, Tiger Moth; Denis Sweeting, Spartan Arrow G-ABWP; and Ron Gillman, Club Cadet G-ACHP), after which Capt. Gillman presented the Cadet in a solo demonstration. The show was undoubtedly stolen, however, by the only pilot to fly in without an engine—Frank Foster in his recently acquired Slingsby Skylark II. Having been launched from Dunstable some four hours earlier, Foster had made a round tour of Bedfordshire before completing his flight with a selection of well-judged aerobatics over Denham.

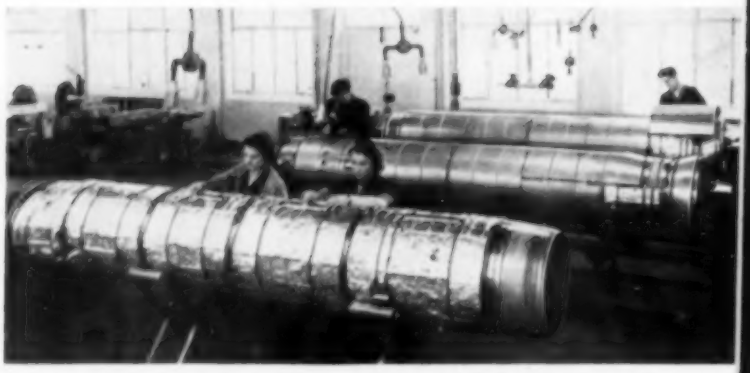
FOR the last twelve months the Armstrong Siddeley Flying Club has been flying from Baginton Aerodrome, Coventry, operating Tipsy Trainer G-AFSC, otherwise known as the *Flying Sphinx*. Previously Elmdon Airport, Birmingham, had been the club's base. During 1954 a total of 172 hours was logged by the club-members—134 hr of this during the last six months—under the guidance of C.F.I. Harold Ashworth and assistant instructor John Hill. The club reports that "this remarkable device (the Tipsy) had now done almost 2,000 not-so-perfect landings without the undercart rubbers being replaced."

At the last A.G.M. the full membership of the club was increased from 24 to 30, and the associate membership to 13. Eleven *ab initio* members, it was recorded, had gone solo during the year. Further expansion, and the purchase of a second aircraft, is hoped for this season.

TOTAL hours flown by the 36 member-clubs of the Royal Canadian Flying Clubs' Association during 1954 amounted to 62,827, in addition to 12,030 hours' refresher training on Chipmunks for R.C.A.F. Reserve officers. The first total shows a five per cent decrease over that for the previous year, due entirely to a drop in commercial-pilot training. The number of private pilots' licences issued, however, increased to just over 1,000, and the total club membership to 7,588. Average aircraft utilization was some 370 hours, the total number of aircraft operated being 170 (excluding 32 Chipmunks on R.C.A.F. contracts).

An analysis of these 170 aircraft is illuminating; the total includes 58 Fleet 80s, 29 Cessna 120s and 140s, 36 Aeronca Champions, five Cornells, three Taylorcraft, four Piper J3 Cubs, one Ercoupe, one Mooney 18C, one Chipmunk, six Piper Cruisers, six Cessna 170s, three Stinson Voyagers, eight Piper Tri-Pacers, four Piper Pacers, one Bellanca and one Navion.

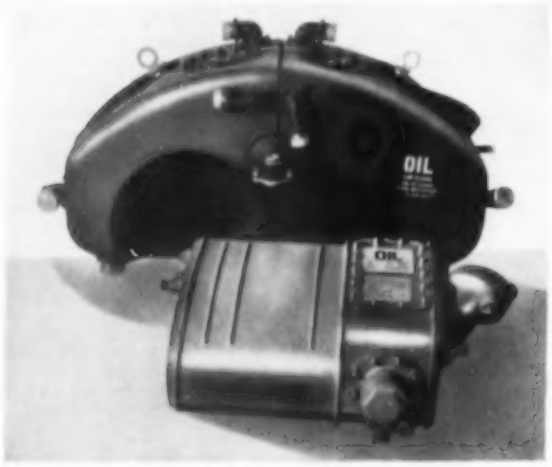
"HOT" PARTS BY THE HUNDRED



Briggs-built jet-pipes for British fighters being made ready for dispatch. That nearest the camera is encased in its insulating blanket.

IT may not be generally known that Briggs Motor Bodies, Ltd., are one of the largest suppliers of "canware" and similar precision components for high-temperature applications in gas turbines. The company entered the aircraft industry in 1939 with the mass-production of exhaust manifolds and various airframe components. Their gas-turbine work, however, dates from late 1950, when they were approached by Rolls-Royce with a view to their manufacture of the nozzle-box panel for the first production series of Avon. This unit, which required a 900-ton press for its manufacture, went into production at the company's main factory at Dagenham.

By the middle of 1951, preliminary planning was under way at Dagenham for mass-production of gas turbine components at the former Cunliffe-Owen factory at Eastleigh, Southampton. Briggs took over the Eastleigh plant in that year, and well over 300,000 sq ft of this modern factory have since been devoted to gas-turbine work for the aircraft industry.

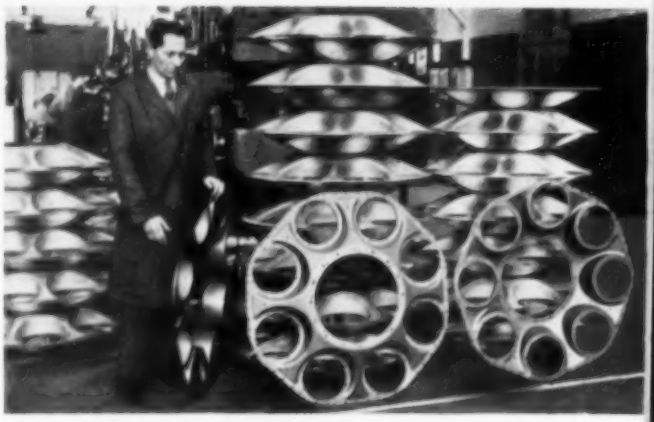


The factory was empty when Briggs took it over and equipment for the new work had to be installed from scratch. Jigs, press tools and the like were originally made at Dagenham, but this work was subsequently shared out to a large number of sub-contractors. The company have installed over 500 specialist machine tools and automatic welders. At the same time, a large labour force had to be raised—a particularly difficult task owing to the fact that the type of work was completely new to the district.

The work involves all forms of close-tolerance machining, grinding, and sheet metal work in the most "difficult" types of heat-resistant steels, stainless and Immaculate steels and the Nimonic alloys. The major part of the company's output (in this sphere) consists of parts for the Rolls-Royce and Armstrong Siddeley companies, and tooling is such that a very high potential rate of output exists.

A new development is the installation of a pre-production set-up, so that complete sets of prototype parts can be made by hand. Briggs are at present hand-making initial sets of gas turbine components for several other companies, including Blackburn-Turboméca and Napier.

Production of components for engines of British design is carried out entirely under the *aegis* of the parent British engine company who, in many cases, re-route the components to overseas factories which are licensed to produce the British engine.



Widely differing gas-turbine components in current production: turbine oil tanks (left) and stacked turbojet nozzle-box panels (above). Such products, seemingly simple, demand numerous manufacturing operations to close tolerances.

Repair work and the manufacture of spares also represents an important part of the company's output. Spare combustion chambers and jet-pipes are being made for at least one British turbojet, and repairs are already proceeding on components for the Avro Orenda for the Canadair Sabre 5 and 6 used by the R.C.A.F. in Europe. Another important item will be the production of spares for the Wright J65 Sapphire, for the U.S.A.F. and also for the various NATO air forces which are to operate the Republic Thunderstreak and Thunderflash.

Briggs supply all major items, such as reheat jet-pipes, ready for installation in an airframe. Temperature-insulating blankets, such as Alfol and Refrasil, are purchased already made up into units tailored to fit the component concerned. Shipments of complete assemblies are made in special crates, either to an English gas-turbine factory, or direct to a Service unit.

A.I.D. OLD-TIMER RETIRES

RETIRING today, May 6th, is one who has had 40 years' experience of aircraft inspection; he is Mr. W. Gwynne, Inspector-in-Charge at the Coventry District Office of the A.I.D.

He first joined the A.I.D. on being invalided out of the Navy in 1916, and during the remainder of World War I was engaged on inspection work in connection with many of the famous military aircraft of that era.

After the war he was at the Bristol Aeroplane Company, his stay there being interrupted by a period at an R.A.F. maintenance unit and another at Boulton Paul, Norwich, where he was principally engaged on the inspection of the framework of the airship R.101. Thereafter he was at the Fairey works, subsequently moving, in 1938, to Armstrong Whitworth Aircraft, where he remained until 1947. Here he was engaged mainly on bomber inspection (Whitley, Lancaster, Lincoln), and ultimately on the Apollo airliner.

His next posting was to Hawkers at Kingston, and after that he was made Senior Inspection Officer (Aircraft) for the Midland Area; his final appointment—that at Coventry—followed.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

King Feisal, A.V-M.

THE Queen has been graciously pleased to approve of the appointment of King Feisal II, G.C.V.O., of Iraq, to the Royal Air Force, in the honorary rank of Air Vice-Marshal. This appointment to the Royal Air Force was made on the King's twentieth birthday, which is also Iraq's National Day.

The announcement was also made at R.A.F. Station, Habbaniya, Iraq, by the British Ambassador on May 2nd, during a ceremony at which the Royal Air Force handed over to the Iraqi Government its bases at Habbaniya, Basrah and Shaibah, under the special Anglo-Iraqi defence agreement announced on March 30th, 1955. The agreement replaces the Anglo-Iraqi treaty of alliance of 1930.

The new Anglo-Iraqi agreement provides for close and continuous colllaboration between the armed forces of the two countries, with joint planning and exercises. Great Britain will, among other things, advise and give technical assistance in establishing an air defence organisation in Iraq, and will retain her present rights of over-flying and landing in Iraq, as well as facilities for servicing British aircraft in Iraq. The R.A.F. squadrons in Iraq will be progressively withdrawn but they will, however, visit Iraq as part of the joint training procedure.

Runnymede Memorial Service

A SHORT Ceremony of Remembrance in commemoration of V.E. Day will be held next Tuesday, May 10th, at the Runnymede memorial. It will be in memory of the officers and men of the Commonwealth Air Forces who lost their lives in the last war while operating from the United Kingdom and North-west Europe and have no known grave.

During a brief service, the Air Member Canadian Joint Staff, London, A. Cdre. A. D. Ross, G.C., C.B.E., C.D. (representing the High Commissioner for Canada), will lay a wreath on the Stone of Remembrance on behalf of the Air Forces of the Commonwealth. After the service representatives of a number of ex-Service organizations will lay wreaths.

No special invitations are being issued, but the Memorial will be open to the public as it is throughout the year. It is emphasized, however, that accommodation in the cloisters is limited, and that those wishing to attend this ceremony should be in their places by 10.30 a.m.

The Handley Page Hastings "Iris II" and the team from the R.A.F. Inspectorate of Radio Services which returned to Britain last week at the conclusion of a world tour. Some details of the tour and the names of the examiners and aircrew appear overleaf.

Exercise Sky High

THE six-day Bomber Command exercise Sky High, which took place last week, ended on Saturday last. In some of the practice attacks over 200 Canberras were employed.

At the end of the first phase, A.V-M. A. McKee, Senior Air Staff Officer at Bomber Command, said: "The exercise has given Bomber Command invaluable experience in deploying its large all-jet force of Canberra aircraft under realistic conditions. It has demonstrated in convincing fashion that at extremely short notice Bomber Command can really live up to its motto, 'Strike Hard, Strike Sure', in support of SHAPE.

"Many new aspects of the control of a large tactical force have been introduced for the first time. The mobility and speed of the Canberra force, now several hundred strong, has stood up to a severe test extremely well. The whole chain of organization, from Command to squadron level, has functioned with clockwork smoothness and efficiency. Pilots, navigators and ground staff have all thrown themselves wholeheartedly and enthusiastically into the exercise. Many have foregone sleep for long periods.

"The serviceability of the Canberra force has undoubtedly been higher than in any previous exercise of a similar nature and the number of aircraft unable to take off on their tasks has been negligible. Sky High has already taught us many lessons and will make a valuable contribution to improving still further the Command's effectiveness."

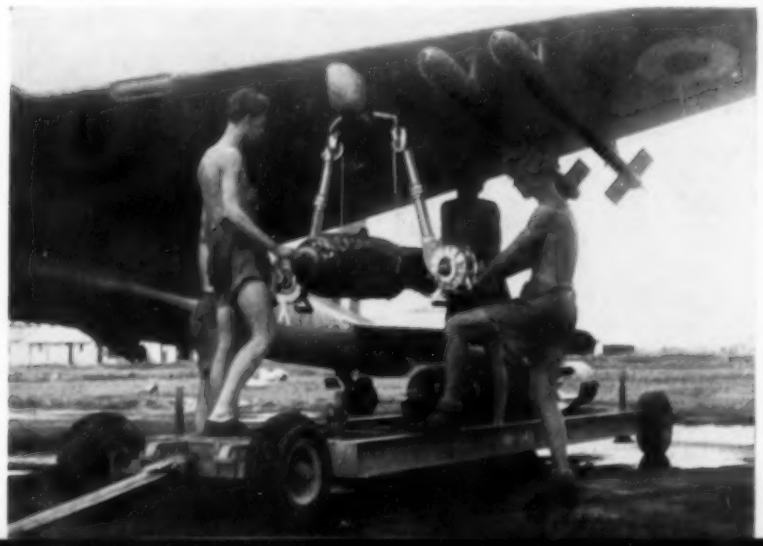
The second phase of the exercise took the form of practice attacks on ranges in Germany and the United Kingdom.

R.A.A.F. Self-sufficient

SPEAKING at Newcastle, New South Wales, recently, Sir John McCauley, Chief of Air Staff of the R.A.A.F., said it was the aim of the R.A.A.F. to become self-sufficient, as it might not be possible to obtain overseas supplies in a future global war. The R.A.A.F., he said, required equipment as well as skilled manpower. Experience had shown that equipment of the right type and quantity was hard to get in war. It was the long-term policy of the R.A.A.F. to foster the highest possible degree of self-sufficiency in industry to meet essential needs in the event of overseas sources of supply not being available.

He said also that about 50 per cent of the R.A.A.F's servicing work, including that on airframes, was done by civil industry at a cost of £1½ million a year.

Referring to the Avon Sabre, now being



Rearming a D.H. Hornet of No. 33 Squadron in Malaya for the aircraft to take part in the unit's 5,000th sortie against jungle targets.

SERVICE AVIATION . . .

manufactured in Australia, he said it was "the best in the world for Australia's particular purposes."

The efficiency of the R.A.A.F. for war depended on the efficiency of the industry which supported it, added Sir John. In improving its efficiency, industry could thus play a decisive part in the air defence of Australia. Of the £45 million voted to the R.A.A.F. each year, about seven-eighths of this was channelled back into the Australian economy in the form of industrial orders.

R.A.F. Wins Small-bore Contest

AS briefly recorded in our issue of April 29th, the Royal Air Force team has again won the Inter-Services Small-bore Rifle Championship. The captain was S/L. C. J. Collins, R.A.F. Ret. Eight of the 40 members of the team returned perfect scores of 200 points out of 200 and a further 13 returned scores of 199 points.

The final scores out of a possible 8,000 were: Royal Air Force, 7,937; Territorial Army, 7,915; Regular Army, 7,859; Royal Navy, 7,849; Royal Marines, 7,841; Home Guard, 7,729; Royal Naval V.R., 7,471. (In the case of the last two only 78 and 79 scores respectively were recorded.)

The R.A.F. Small Arms Association have received a letter of congratulation from their president, Air Chief Marshal Sir Ronald Ivelaw-Chapman, Vice-Chief of the Air Staff.

2nd T.A.F. Appointment

THE Air Ministry announces that A. Cdre. W. P. G. Pretty, C.B.E., has been appointed Air Officer in charge of Administration, 2nd Tactical Air Force. He will assume the acting rank of A. V-M.

Since January 1952, A. Cdre. Pretty has been Director of Electronics, Research and Development (Air) at the Ministry of Supply. He has been a signals specialist since 1934, and during the war was engaged on signals and radar duties at the Air Ministry and at Fighter Command.

Arctic Flights

A DETACHMENT of 33 officers and airmen from the R.A.F. Flying College, Manby, Lincolnshire, were due to leave in two Hastings aircraft yesterday, May 5th, for an overseas and high-latitude training exercise, in which flights will be made to the North Geographical Pole from Resolute Bay, Canada. The detachment is led by the Commandant, A. Cdre. G. A. Walker.

The captains of the aircraft will be W/C. W. J. Burnett, D.S.O., D.F.C., the officer commanding flying at the College, and F/L. J. C. Wright.

After the Polar exercise the detachment will visit units of the Royal Canadian and the United States Air Forces.

Operation Manna Commemorated

LAST Friday, April 29th, Lincolns of Bomber Command commemorated the 10th anniversary of Operation Manna by scattering flowers and goodwill leaflets over The Hague. During the ten days between April 29th and May 8th, 1945, Lancasters and Mosquitoes dropped 6,685 tons of supplies to the starving Dutch.

In connection with the commemoration the Imperial War Museum, Lambeth Road, London, is exhibiting for the first time a remarkable testimonial produced by a group of Dutch citizens a few days after the food-dropping began. It is a volume sponsored by the "Portico Club," a group of people at Voorbourg (a suburb of The Hague) who secretly listened to B.B.C. news bulletins during the German occupation.

New A.O.C. Ceylon

AFTER having spent the past year as Group Captain (Org.) at Flying Training Command, G/C. H. W. Mermagen, C.B.E., A.F.C., has been appointed A.O.C. Ceylon. He will assume the acting rank of air commodore.

G/C. Mermagen will be remembered by many for his brilliant aerobatic flying at pre-war R.A.F. Displays. In the Battle of Britain he was in command of No. 222 Squadron, a Spitfire unit, and held a number of other fighter and staff appointments in the later stages of the war. In 1945 he commanded the R.A.F. Element of Berlin Air Command.

A.T.C. Appointment

THE appointment is announced of G/C. D. E. B. Wheeler, D.F.C., as Group Captain Cadets at H.Q. Home Command. As such, he is responsible for the administration of the Air Training Corps and for the R.A.F. Sections of the Combined Cadet Force in many schools and colleges throughout the United Kingdom, representing a total membership of some 35,000, and 202 R.A.F. Sections of C.C.F. units account for an additional 8,093 boys.

Among a number of wartime appointments G/C. Wheeler commanded No. 13 Squadron from the start of the final drive in 1944 until the German surrender in 1945. He is an enthusiastic dinghy-racing helmsman and yachtsman.

W.R.A.F. Visit Denmark

THIRTY-FIVE members of the Women's Royal Air Force serving with the Second Allied Tactical Air Force in Germany were due to travel to Copenhagen yesterday, May 5th, to take part in a parade with Danish and American airwomen the following day. The parade formed part of the celebrations to mark the 10th Anniversary of Denmark's liberation, and the salute was being taken by Queen Ingrid.

The contingent, which is composed of 30 airwomen, three senior N.C.O.s and two officers, are the guests of the Danish Women's Auxiliary Air Force, and during their stay are living and being entertained in the homes of Danish airwomen.

Among the British guests invited to attend the parade is Air Commandant Dame Nancy Salmon, D.B.E., A.D.C., Director, Women's Royal Air Force.

Iris II Returns

WHEN *Iris II*, the specially equipped Hastings of the R.A.F. Inspectorate of Radio Services, returned home on April 28th from a world tour of inspection it had covered nearly 30,000 miles and visited 13 countries. The Hastings has on board examples of every airborne radio and radar apparatus in current use in the R.A.F.

Members of the inspectorate on the tour were: G/C. C. C. Morton, C.B.E., W/C. A. R. Glading, S/L. J. S. Knox, D.F.C., A.F.C., and F/L. W. H. E. Austin. In the crew were F/L. H. H. Roffey, F/L. A. P. Brown, F/Sgt. A. P. Fraser, Sen. Tech. J. C. McCafferty, F/Sgt. T. Currie, Sgt. F. Johnstone and Sen. A/C. J. B. Webster.

Sgt. Johnstone, the assistant signaller in the crew, is also a member of the R.A.F. Amateur Radio Society. He took with him a home-made transmitter measuring only 10 in by 8 in with which he was able to keep in touch with Benson during most of the tour; only from Hong Kong was he unable to make contact.

Reunions

THE tenth annual reunion of the H.Q. Bomber Command, association of officers is being held at H.Q., Bomber Command, High Wycombe, Bucks, on May 21st. Details from the honorary secretary of the association, H.Q., Bomber Command.

No. 157 Squadron Association: Reunion at the Blue Posts, Kingly Street, off Regent Street, London, W.1, at 7 p.m. on May 21st. Details from Mr. Cordery at Maida Vale 7601.

At sea on her first commission, "Ark Royal" is now working up. She is seen here with a Seahawk and a Wyvern flying overhead.

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Problems of flight

FORMATION FLYING

Aircraft fly in close formation so that they can be closely controlled for attack, defence, deployment. A flight in formation can change direction or altitude or speed with the precision of a company of Foot Guards on the square. The technique of formation flying—so spectacular to watch, so essential for air tactics—is made possible by communications. There must be constant pilot-to-pilot contact. The commander must be able to give anticipatory orders to all his pilots, or any one. Who could conceive of tactical bombing (for example) without this tight and continual control?

But what of Nature's formation flying? What of a skein of geese, that astonishing wedge of fast-flying birds that plot a course by some immemorial skill to their feeding-grounds in the South? What device of command directs them into their formation, and keeps them in it, over continents and oceans? What of a flock of plover, a hundred strong, turning in the air so exactly on the second that you see, suddenly, a hundred pale undersides where you saw a hundred dark backs? What system of communications tells every bird in that flock the exact moment to turn, the exact direction to fly?

We know why these birds fly in formation. Their reasons are the same as ours. They find safety and effectiveness in numbers, and they must keep these numbers together. But we do not know how they do it. Possibly we never shall. We can only say that some instinct, as old as the species, impels the geese to join into a particular formation for their journey; we can only say that some telepathy, more mysterious than wireless and far more efficient, gives every plover the same order at the same moment.

The deployment of aircraft in formation makes possible the tactics of modern air warfare. But formation flying is more ancient than man himself. It is another of Nature's solutions to the problems of her flying creatures that we, a million years later, have managed to imitate.

Whether flying in formation or alone, pilots who land at airfields all over Britain have come to value the excellent and helpful service of the Shell and BP Aviation Service.

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CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Sky Riddle Answered?

I WAS interested in the "sky riddle" posed by Mr. Nash in your issue of April 22nd, as I witnessed this phenomenon as recently as last Easter Monday. Hitherto, I had neither seen nor heard of it.

The phenomenon was produced by a B-47 flying very high in a cloudless blue sky. It took the form of a deep-blue projection, possibly over a mile in length, which preceded the aircraft in the manner of a parallel pencil of light—or, to be more accurate, a pencil of darkness. The aircraft was leaving a lengthy and immaculately straight condensation trail, the origin of which was lost in the glare of the sun. The sun was thus shining *along* the trail, and I can only assume that it was projecting a shadow of the trail ahead of its source, thus producing a visible optical phenomenon.

To achieve perfection in "blue pencils" the aircraft would require to be in a shallow dive directly out of the sun, and at an angle of dive identical to the angle of the sun's rays. However, internal reflection of the sun's rays within the condensation trail itself could doubtless bend the light enough to produce the phenomenon, without the aircraft having to follow the precise track mentioned above.

The time, date, and the direction in which the Canberras reported by Mr. Nash were proceeding would seem to be consistent with this proffered explanation.

All of which is very disappointing, for my immediate reaction was to believe that the long-awaited "death ray" had at last been added to the Allied armoury.

London, E.6. D. K. Fox.

Airline Pilots and the A.R.B.

ON page 509 of April 22nd edition of *Flight* appears the announcement of Capt. A. M. A. Majendie's appointment to the A.R.B. It is stated that the pilots are likely to welcome this appointment. This is unfortunately not so, as the vacancy that Capt. Majendie is filling is that of "the professional pilot" member of the Council of the A.R.B.

Since 1945, B.A.L.P.A. has consistently maintained that there should be an experienced practising pilot on the Council of the A.R.B., and B.A.L.P.A. claims that this is the intention of section 7(b) of the 1949 Civil Aviation Act (and the Acts which preceded it). Capt. Majendie is no longer a practising professional pilot, and his appointment has been strongly opposed by the Association. As recently as April 20th of this year, the chairman of B.A.L.P.A., in person, made an urgent plea to the Minister pointing out that Capt. Majendie was not a practising professional pilot, but was in fact an employee of a well-known aircraft manufacturing concern, and that the manufacturers were already represented in strength on the Council of the A.R.B.

It is interesting to note that the expression "professional pilot" representation was first introduced in a letter written by the Minister of Civil Aviation as far back as 1946, when the Association was largely instrumental in persuading the Minister of the day to appoint a practising pilot as a member of the A.R.B. Council. Unfortunately, the pilot when appointed subsequently joined the management of our largest operator, and ceased to be a practising professional pilot. Like the manufacturers, the operators are also represented in strength on the Council of the A.R.B.

Our position to-day is thus back to where we were some nine years ago. So much for progress!

We will continue to take all steps within our power to ensure in the interest of public safety that the pilots who fly the aircraft have some small say in the safe certification of those aircraft; such, we maintain is the intention of the 1949 Civil Aviation Act.

In fairness to Capt. Majendie, we would like to make it clear that we have nothing personal against him—quite the contrary. We consider that his experience well qualify him to represent the manufacturers on the Council of A.R.B. But we do not see how he can represent the "professional pilots" since the plain fact is that he is not one.

London, W.1 A. Spooner,
Chairman, British Air Line Pilots Association.

[We sympathize with the viewpoint expressed and appreciate the principle involved. Capt. Majendie's appointment is nevertheless valuable, both for professional pilots and the A.R.B. He was himself a B.O.A.C. pilot for eight years until last year, when he joined Smiths Aircraft Instruments as aviation research liaison officer.—Ed.]

Light Aircraft Revival

TOUCHED by the note of despair evident in your editorial of April 8th, I am sending you a few suggestions for the resurrection of the light aeroplane movement.

If you should find me a trifle brusque in places, please be charitable enough to remember that my list was not compiled only for your benefit. Moving as I do among only a couple of clubs, I am struck firstly by the immense club spirit about the place and secondly by the all-pervading feeling that nobody wants us anyway; and it really does seem that we must look to the power of the Press to help us to raise our own morale.

Stop moaning and do something: (1) Have a whole page each week for club news. There will be no trouble in filling it; at present the Clubs feel that they will not get any mention, anyway. (2) Have a monthly light plane supplement, with lightly instructive articles for the benefit of club pilots, reminiscences and so on. (3) Resurrect the old light aircraft special edition.

Give some active encouragement: (1) Invent some form of competition which will not be too expensive for the average club pilot to enter.

Reduce costs: (1) Start a fight with A.R.B. to get limited licences for ex-R.A.F. tradesmen, so that they can do flight servicing for their clubs' particular aircraft. The professionals are mostly overloaded, so would lose nothing, and a bit of competition would be a good thing.

Publicity: (1) Spread the news that flying clubs exist. At present the only publicity we get is when we prang, and that usually brings quite a lot of enquiries. (2) Start reminding the world at large of what the flying clubs did in pre-war years and that they will probably get the opportunity to do it again. (3) Publish a selection of the more fatuous complaints. There must be a vast store of suitable material available. A cartoonist could do a lot here.

New aeroplanes: (1) Start a controversy on the best type for replacement of our present equipment and get people to put their ideas on paper. This will keep the thought alive long enough for someone to do something about it.

London, S.W.18. J. D. Scarlett.

[We always welcome, and print, worthwhile news from clubs. Our correspondent does us an injustice if the reference to "prangs" is also intended to apply to *Flight*.—Ed.]

Poetic Justice

WITH reference to your caption to the group photograph published in *Flight*, page 472, April 15th, on the occasion of the visit of Mr. George Ward to Handley Page, Ltd.:—

The flight test observer
should surely deserve a
brief mention as well
when you carefully spell
out each name—*except one*
as we stand in the sun,
by the Victor so fine,
with the crescent design.
Messrs. Harvey and Ward
had just flown, and on board
was the crew, too, you see—
Mr. Allam and me.
I think it's a shame
that you don't know my name!

St. Albans, Herts. R. H. Williams.

FORTHCOMING EVENTS

May 2-13. British Industries Fair: Olympia, London and Castle Bromwich, Birmingham.
May 7-9. Channel Islands Aero Club: International rally.
May 7-9. Tangier Air Rally.
May 12. Women's Engineering Society: "Heavy Civil Engineering Works," by C. K. Haswell, B.Sc. (Eng.), M.I.C.E.
May 14. British Interplanetary Society: Short paper evening.
May 17. Aircraft Golfing Society: Match v. R.A.E.
May 19. R.Ae.S.: The 43rd Wilbur Wright Memorial Lecture: "Flight Control," by Dr. C. S. Draper, F.I.A.S.
May 20. Institute of Navigation: "Automatic Dead Reckoning Instruments," by H. C. Pritchard.
May 21-23. Zoute Aviation Club: International rally.
May 27. Royal Aircraft Establishment: Senior Staff Mess Ball.
May 29-30. Aero Club of Ireland: Flying Display.
R.Ae.S. Branch Fixtures (to May 23):
May 9, *Halton*, "The History of Parachuting and Ejector Seats," by R. D. Trender. May 11, *Chester*, Annual general meeting. May 12, *Glasgow*, "Aviation Fuels," by C. F. Holloway. May 16, *Halton*, Film Show. May 18, *Hatfield*, Annual general meeting. May 23, *Halton*, "Dynamic Heating (the Heat Barrier)," by S/L. P. C. Cleaver.

THE INDUSTRY

The Sugg Solar A.P.U. in Action

WE have recently made a number of allusions (notably in our issue of January 21st, 1955) to the Solar Mars gas turbine auxiliary power unit and to the fact that it is being manufactured under licence in this country by Sugg Solar, Ltd., a subsidiary company of William Sugg and Co., Ltd., of London, S.W.1. Last week we had an opportunity of seeing two of these remarkably compact little units demonstrated, one operating a fire pump (415 gal/min at 100 lb/sq in) and the other a 28-volt 14 kW (continuous) generator; the latter was a complete A.P.U. as now being used in some 350 aircraft of the U.S.A.F. (the Convair C-131B electronic test-bed actually has two Mars units in underwing pods).

The fire-pump installation—a prototype—had hand starting by means of a pair of cranks and gearing, and we had the novel experience of thus spinning up the rotor until it was possible to feel combustion taking over the work. The electrical set had battery starting and the celerity with which full operational turbine speed of 40,300 r.p.m. was attained was remarkable; the tachometer needle reached this figure in less than 10 sec after the starter switch had been pressed.

In both cases the efficiency of the fuel-flow governor was noticeable; the fire pump, for example, was delivering two powerful jets through 3½in hoses, yet either or both could be closed down or opened up without the slightest variation in engine speed showing on the tachometer. Though the Mars could hardly be called quiet in operation—it has the typical high-pitched scream of any gas turbine—the volume of noise is not comparable with that of an aircraft turbojet or turboprop. Slight surging could occasionally be heard, but made no apparent difference to engine speed.

Another aircraft application of the Mars is to ground starting units; continuous starter power is 650 amp, plus 250 amp service power. A starting overload of 800 amp for 2 min is permissible.

Sugg Solar are now tooling-up in a new factory at Crawley, Sussex, where production should begin this summer.

Honour for Wellworthy Chairman

THE town of Lymington, Hants, has conferred its Freedom on Mr. J. W. Howlett, O.B.E., the founder, chairman and managing director of Wellworthy, Ltd., manufacturers of piston rings, pistons, cylinder liners, aero engine castings and other components. This is only the third time in its 800-year history that the borough has bestowed this honour on one of its inhabitants.

Mr. Howlett, who is now 72 years old, started his company in 1918 with seven employees; they began with the manufacture of piston rings and progressively extended their activities to other engine components. Shortly before the Second World War the firm co-operated with Rolls-Royce, Ltd., in producing a piston-ring material—D.T.D. 485—which played an important part in the efficiency of the Merlin engine. "Without this material," said the general manager of Rolls-Royce in a letter to Wellworthys, "it would not have been possible to obtain the required power from these engines or the successive improvements in the performance of aircraft which were required to keep in advance of enemy progress."

The Simon platform in a typical servicing position.

Versatile Hydraulic Platform

BASED on a Canadian design—originally conceived for fruit-picking in orchards—an ingenious hydraulic maintenance platform is now being manufactured in this country by Simon Hydraulic Machinery (branch of Thomas Adshead and Son, Ltd.), Queen's Cross, Dudley, Worcs. As will be seen from the photograph above, it consists primarily of an articulated jib mounted on a reversible turntable, both sections of the jib being raised or lowered as required by means of hydraulic jacks, while the turntable is actuated by a hydraulic motor. Power for the hydraulic pump is supplied by a small petrol engine. The working platform, which will accommodate one or two men and a load of tools, etc., to a total weight of 750 lb, is retained in a horizontal position by radius rods.

The platform can be elevated or swivelled to any required position up to a height of 36ft above ground, or to a maximum horizontal extension of 23ft. The device can be mounted on any twin-rear-wheel chassis of three tons or over, provision being made for locking the springs and for the use of outrigger feet to provide stability when the jib is extended horizontally. It can also be mounted on rail vehicles.

All movements are governed by a set of foot and knee controls on the platform, or operation may be independent from the base of the jib. Control is simple and accurate and—as we were able to establish for ourselves during a recent test—the platform remains remarkably rigid at all positions and even when comparatively sudden changes of motion are imposed.

A Simon hydraulic platform has been on trial for the past three months with the Bristol Aeroplane Co., Ltd., where it has been used for work on Britannia tail units and for the fitting of helicopter rotor blades on test rigs; it has, we understand, been found valuable for these and a number of other duties. (Works maintenance, window cleaning, etc., are obvious applications.)

Simon hydraulic machinery are building the equipment for all markets except North America.

Mr. Leslie T. P. Banbury, who has been made a director of Dowty Equipment, Ltd.; he is already a director of several of the Dowty companies. (Right) Mr. K. A. N. Mills takes over from Mr. Banbury the position of secretary of Dowty Equipment, Ltd. Mr. Banbury remains secretary of the parent company, Dowty Group, Ltd.

Mr. A. H. Monser, A.F.R.Ae.S., M.I.P.E., M.P.O.A., recently appointed chief buyer of the Bristol Aeroplane Company's engine division.

Mr. O. T. Jones, the Vacuum Oil Company's chief automotive engineer, has retired after 35 years. Mr. C. G. Tresidder, A.M.I.Mech.E., succeeds him.

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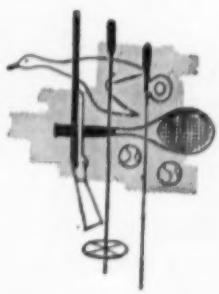

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The Publishers retain the right to refuse or withdraw advertisements at their discretion and do not accept liability for delay in publication or for clerical or printer's errors although every care is taken to avoid mistakes.

Situations Vacant. The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

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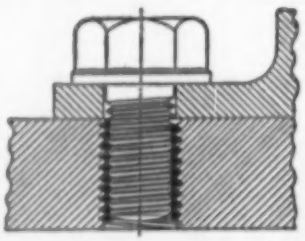

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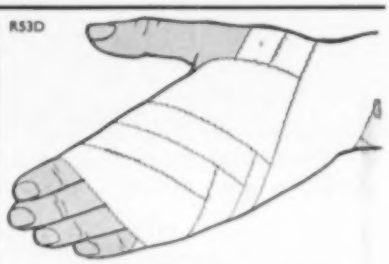

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate scheduled air services:

APPLICATION No. 473. From Derby Aviation, Ltd., of Derby Airport, Burnaston, Derby, for a Seasonal U.K. Internal Service with D.H.89 and Dakota aircraft for the carriage of passengers and supplementary freight between Nottingham (Tollerton) and Isle of Man (Ronaldsway) with an intermediate traffic stop at Derby (Burnaston) at a frequency of up to three services on Tuesday, Saturday and Sunday, during the season from May to September inclusive, each year, for a period of seven years, commencing 1st May, 1955.

APPLICATION No. 474. From Air Charter, Ltd., of 15 Great Cumberland Place, London, W.1, for a Vehicle Ferry Service with Bristol 170 aircraft for the carriage of vehicles, passengers and supplementary freight between Southend and Ostend at a frequency of one service daily increasing according to traffic demand for a period of 10 years, commencing six months after date of approval.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing stating the reasons and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3 Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [3664

PUBLIC APPOINTMENTS

SENIOR Scientific Officers; Scientific Officers. The Civil Service Commissioners invite applications for pensionable appointments. Applications may be accepted up to 31st December, 1955, but early application is advised as an earlier closing date may be announced. Interview Boards will sit at frequent intervals. The scientific posts cover a wide range of scientific research and development in most of the major fields of fundamental and applied science. In biological subjects the number of vacancies is small: individual vacancies exist for candidates who have special knowledge of, or who are interested in palæobotany, foraminifera, and recent and pleistocene mammals.

CANDIDATES must have obtained a university degree with first or second class honours, in an appropriate scientific subject (including engineering) or in mathematics, or an equivalent qualification; or possess high professional attainments. Candidates for Senior Scientific Officer posts must in addition have had at least three years' post-graduate or other approved experience.

CANDIDATES taking their degrees in 1955 may apply before the result of their degree examination is known.

AGE limits: Senior Scientific Officers, between 26 and 31, but specially suitable candidates under 26 may be admitted. For Scientific Officers between 21 and 28 during 1955 (up to 31 for permanent members of the Experimental Officer class). Salary (London) Senior Scientific Officers: (men) £1,010—£1,185; (women) £893—£1,077. Scientific Officers: (men) £492—£885; (women) £492—£795. Women's scales subject to improvement under equal pay scheme. Somewhat lower rates in the provinces.

FURTHER particulars from Civil Service Commission, Scientific Branch, 30 Old Burlington Street, London, W.1, quoting No. S.53/55 for Senior Scientific Officers and S.52/55 for Scientific Officers.

ROYAL Mint has a vacancy to be filled as Scientific Officer or Senior Scientific Officer according to qualifications and experience. Candidates must have first or second class honours degree in Metallurgy or in Physics and Chemistry if with metallurgical experience. The general qualifications and conditions are as set out in the main advertisement above. Candidates for this post should quote S.4424/53/55 and the closing date for applications is 31st May, 1955. [3649

MINISTRY OF SUPPLY: Air Traffic Control Officers. The Civil Service Commissioners invite applications for three non-pensionable Grade III posts at the Royal Aircraft Establishment, Farnborough, Hants. Age at least 23 and under 35 years of age on 1st May, 1955. Candidates must have reached the standard of education represented by the pre-1951 school certificate with matriculation exemption or its equivalent in terms of the General Certificate of Education or Scottish Leaving certificate, or hold an appropriate technical qualification. They must have had experience either as (a) aircrew in civil air transport, preferably as pilot or navigator, with considerable experience in the United Kingdom, or (b) pilot or navigator in the Armed Forces, preferably with considerable experience of air traffic control in the United Kingdom. Exceptional candidates without aircrew experience will be considered, provided they meet the educational requirements given above, and have had considerable practical experience either in civil aviation or in the Armed Forces of duties directly concerned with the operation of air traffic control. Additional assets will be a general knowledge of civil aviation legislation and practice, and of radio and radar aids to navigation, and working knowledge of the French language. Starting salary according to age, from £507 (at age 23) to £776 (at 30 or over) rising to maximum of £1,021. Somewhat lower for women. Further particulars and application forms from Civil Service Commission, Burlington Gardens, London, W.1, quoting No. 4452/55. Completed application forms to be returned by 19th May, 1955. [3651

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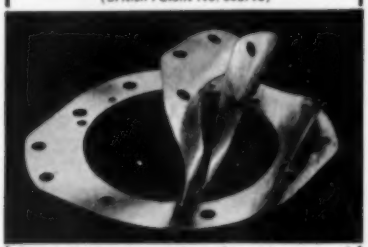

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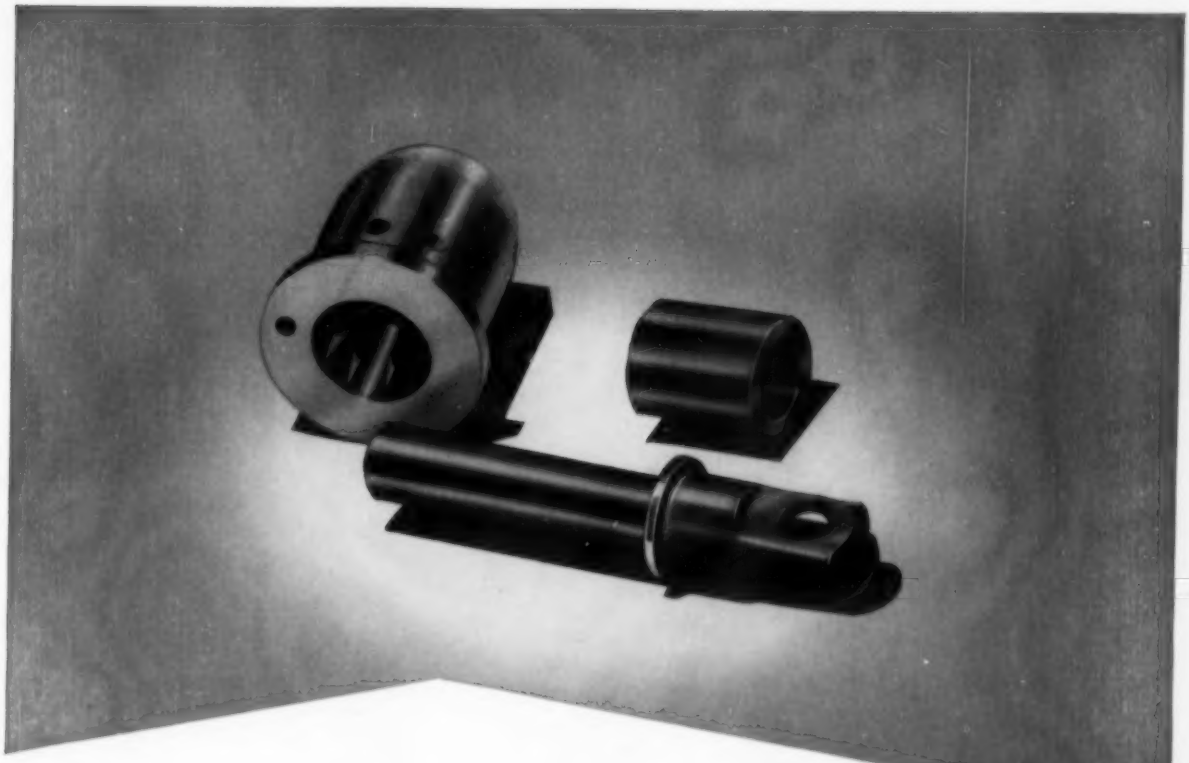

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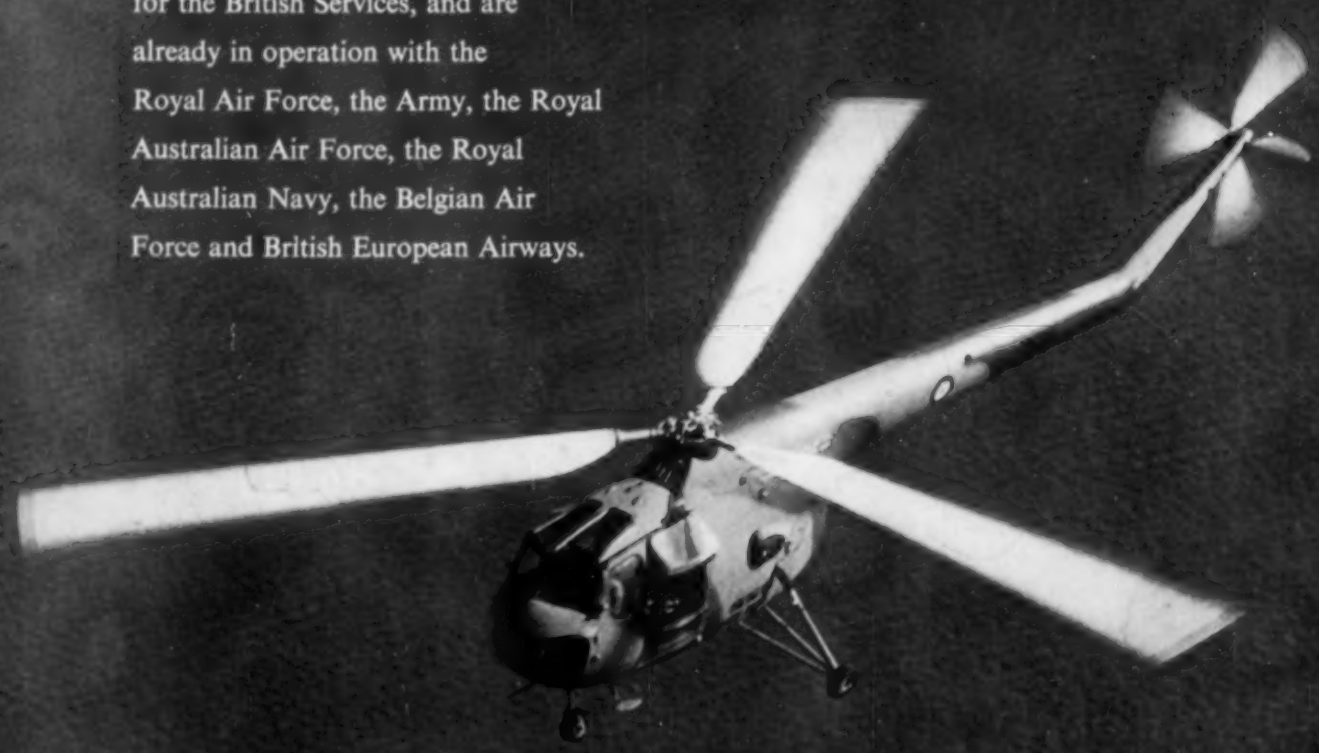

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